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The Clinical Study of 500 consecutive
cases of Scarlet Fever, with some reference to
Opsonic Values in this Disease.

Thesis by

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The Clinical Study of 500 consecutive cases of Scarlet Fever with some reference to Opsonic values in this disease.

The subject of Scarlet Fever has absorbed the attention of so many writers and investigators that it is impossible for me to condense it to one paper. Therefore I propose to confine myself to the study of 500 consecutive cases which have come under my charge at the Park Hospital, Hither Green, S.E. during the winter of 1906-1907, paying special attention to the complications and the opsonic changes in the blood serum against Streptococcus.

I shall deal with this subject in the following order and shall describe it in III main chapters.

Chapter I. Will take up the symptoms and peculiarities of the 500 cases paying special attention to the fatal Cases and the subsequent autopsies.

Chapter II. Will deal with the complications that occurred, in the following order:-

Firstly Nephritis. Its frequency, with observations on the morphology and on the part which the tonsil and teeth play in the complication. With some remarks on its Bacteriology and Aetiology.

Secondly Otitis. Its Cause, Bacteriology and the frequency with which one finds Pus in the Mastoid cells in fatal

cases of Scarlet Fever, there having been no previous external manifestation of this condition.

Thirdly Adenitis, with reference to its treatment by means of ice bags.

Fourthly Rheumatism and other Complications.

Chapter III. Will describe the investigations I have carried out as to the opsonic changes in the blood-serum against Streptococcus (Conglomeratus and Pyogenes) and against Staphylococcus; first in ordinary cases of Scarlet Fever, then, in those cases in which the complications of Nephritis arose, describing the characteristics of the various Streptococci which were used.

12 Microphotographs will illustrate some of the points observed.

Chapter I.

Scarlet Fever stands out as being one of the most important of the infectious diseases to which man is liable, on account of the high death-rate which at times it has. During the decennial period of 1871-1880 the death rate rose to 716 per million of the living population of Great Britain. Fortunately this high Death Rate has fallen markedly in recent years. In the period of 1891-1895 it fell to 182 per million, and in the period of 1896-1900 to 135. But Scarlet Fever is to be feared most on account of its disastrous complications which are of so common an occurrence in this disease. Such as Nephritis, Albuminuria, Otitis and Adenitis, besides the many other less important and perhaps rarer complications.

The annual rise in the number of Scarlet Fever patients admitted to the Metropolitan Asylum Board Hospitals in London reaches its maximum the end of November. Particularly at this time, it is necessary to transfer convalescent patients from this Hospital to Gore Farm, a convalescent hospital situated in Kent. This proceeding has the advantage of relieving the congestion and also of lessening the risk of infection, in that patients are not discharged straight from an acute hospital. Patients are only transferred to Gore Farm after they have been in an acute hospital for at least 24 days and

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are free from any serious complications. Of the 500 cases that came under my care 260 were sent to Gore Farm during the fourth week of illness. 134 went later, having been detained by slight complications. The rest, 106, remained in this hospital for convalescence. Of the 394 patients that went to Gore Farm none died but amongst the others there were 7 deaths.

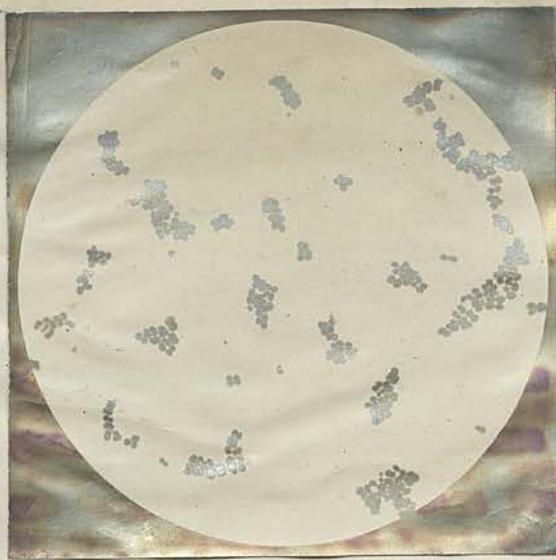
The following list shows at a glance the ages and sex of the 500 cases and will be useful for further reference. This series of cases shows a fair average number of cases of all ages.

Under	M	3	Total	15-20	M	20	Total
1	F	1	4		F	23	43
1-5	M	58		20-30	M	23	
	F	53	111		F	29	52
5-10	M	72		over	M	7	
	F	60	132	30	F	6	13
10-15	M	76					
	F	69	145				

Of the symptoms noted in these cases I find that 302 of the 500 cases complained of headaches, 457 had sorethroats which in the large majority of cases were of the red injected Scarletiform type. The post pharyngeal wall in early cases was often seen to be paler than the other parts of the Buccal Cavity. Often there was some slight yellowish

exudation. On taking cultures from the throat in early Scarlet Fever, I found that Staphylococcus Pyogenes Aureus and Albus were very evident in almost all of the cases, when grown on blood serum or agar. Streptococcus apparently was not so evident in these cases. Although Goadby^X has stated that Streptococcus is to be cultivated from any mouth where there is Sepsis. Certainly it is usually absent in cases of Diphtheria which are often very septic. It was only seen three times in 50 consecutive cases of Diphtheria after 15 hours cultivation. I found that it was often present in small amounts but apparently was rapidly overgrown by the luxuriant Staphylococcal growth. But in 50 cultures taken from convalescent Scarlet Fever throats during the 3rd and 4th weeks I found Streptococcus was present in half the cases, and grew abundantly on cultivation on Blood Serum agar or nutrient Broth. Large Tetrads of which I show a photograph were present in 15% of the early cultures taken. Besides these one found Streptothrices, Long and Short Bacilli. Yeast Fungus thick and thin threads, besides various forms of other Cocci and Fungi

^X K.W. Goadby, Lancet 9.3.1907.



This Photograph shows a large Coccus often of a Diplococcie nature often arranging itself in Tetrads.

300 or 60% of the 500 cases vomited during the onset of the disease and I find that of those that vomited 163 were children under 10 years of age, and I conclude that Vomiting in Scarlet Fever is more common amongst children than adults, as is usually stated 65.9% of the children under 10 vomited. But Vomiting amongst adults is more common than is usually stated. Of these cases Vomiting was present in 137 cases or 54.1% of the total number of adults over 10 years of age. 480 of the cases were admitted with Rashes and 19 came in desquamating.

X Of the rashes 18 showed definite Miliaria. Griffith insists that this clinical form of the disease is not an indication of severity of type; nor is there any consonance between the amount of Miliaria eruption and the degree of Scarlatinous desquamation. Certainly one has seen these cases running very mild

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courses, with by no means an abnormal amount of desquamation. 15 became blotchy and almost Morbilliform; especially well seen over the joints in Septic cases. Three showed a definite secondary punctate Scarletiform Erythema and one case showed this condition, whilst desquamating typically and freely. The temperature here rose for a second time and the tongue furred and peeled twice in the usual fashion. One case was peculiar in that it always showed a Scarletiform erythema on being exposed - Evidently a peculiar form of blushing which almost led to an error in diagnosis. Three of the cases showed secondary Purpuric conditions 2 of which recovered without any discomfort, one case (Florence Mayhew) aged 3 years showed a marked dark Purpuric Rash on the abdomen; at the end of the 5th week, it gradually got worse, until death at length supervened on the 41st day of disease. Dr.

X
McAllister describes in his paper on the Prognostic Significance of Purpuric rashes; some cases of purpura in Scarlet Fever one of which was fatal, and his case like that of Florence Mayhew was a very septic one; with profuse Nasal discharge, Otorrhoea, suppurative Adenitis, and a filthy mouth. And it is probably to be considered as due to the general Septicæmia rather than as a definite complication of Scarlet Fever.

X The Prognostic Significance of Purpura in children
by G.H.K. McAllister, a paper read before the Physical Society

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X
Biss reports a septic case with double Otitis Media which developed purpura on the 19th day and rapidly succumbed.

X
Welch and Shamberg state that these secondary Purpuric Rashes are not seen alone in Scarlatina. They occur in other infective diseases such as Influenza, Rheumatism and Small Pox etc., and state that they are probably due to some secondary infection which destroys either the integrity of the blood or the vessel Wall.

X
Jurgensein describes these extravasations of blood under the skin and even into some of the deeper organs especially in these septic cases as due to a failure in nutrition and as distinct indications of the injury suffered by the entire system in such cases.

Four cases showed early and small cutaneous ecchymoses when the rash was evident. These were cases in which the specific eruption was very profuse and must not be taken for an expression of a general severe infection, but rather as one of the extreme

X Biss Lancet Aug 2nd 1902 Page 286

X Welch & Shamberg Accute Contageous Diseases Page 421.

X Nothnagel Page 524

congestion of the skin. These slight early
 Hemorrhagic conditions are not nearly so important
 as in Smallpox where the prognosis is so greatly
 altered by such a condition. The redness of the
 rash was seen in most cases to disappear on pressure,
 also often the skin on slight mechanical stimulus
 such as drawing a pencil slightly across the abdo-
 men_A was seen to become pallid as far as the Stimulus extended.
 This probably depends on the increased excitability
 of the Plain_A^{muscle} fibre of the smallest capillaries. This
 cannot, however, be used as a diagnostic symptom of
 X
 Scarlatina as Bouchut claims. Hanoeh and Thomas
 have lately taken a well founded exception to this
 rule.

One has also frequently seen it present in
 other diseases Rotheln for instance.

X Circumoral pallor was noticed in the large
 majority of those cases where the rash was very
 evident and bright. This condition has been said
 to be caused by a poor blood supply to the part.
 But one does not find the region of the lips to
 have a very poor blood supply. Vaso-motor changes,
 as spasm of the small vessels, must take a large
 share in its causation.

X Nothnagel Page 489 Scarlet Fever.

X Jurgensein Nothnagel Page 487.

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About 95% of the cases showed the typical pin point and ringed desquamation. Several cases showed a flaky desquamation, and one case showed the complete glove finger form. The desquamation was usually of a coarser and more flaky type on hands and feet, whilst the scalp and face sometimes showed a less typical branny form. Desquamation was usually seen to begin about the pubes, axillae or neck; whilst the rest of the body was comparatively smooth. Desquamation beginning all over the body at once is rarely due to Scarlatina. This point was well seen in 3 cases of Chronic desquamative Dermatitis and one of Ichthyosis which were sent to this hospital as suffering from Scarlet Fever; here also the desquamation was linear and not ringed.

27 cases showed the desquamation starting as definite small blisters which had the appearance of drops of a milky fluid being sprinkled on the abdomen and chest; later, these blisters had their tops rubbed off and one saw the typical ringed desquamation commencing apparently from each puncta of the rash which formed a little blister before desquamation. This shows how the typical ringed Scarlatinal desquamation is formed. It is a peculiar fact that all these cases came in the last 150 cases of the series and occurred in the first quarter of the year 1907; while none occurred

during the last quarter of the year 1906. One might infer from this fact that it was a slightly different type of disease during the early part of 1907.

Four cases showed slight but definite secondary attempts at desquamation. ^X Thomas reports a case where the desquamation repeated itself some five or six times.

Regurgitation occurred in four of the cases. This is not due to a paralysis of the soft palate; but is merely the result of the inflammatory processes in the area involved. This symptom was well marked in those cases where there was obvious ulceration and perforation of the Palate. It is distinguished from the regurgitation in diphtheric paralysis by absence of anesthesia of the palate with loss of the Reflexes which is often accompanied by other obvious paralysis - accomodation etc.

//

Of the 500 Cases there were 7 deaths, I shall briefly describe these cases:-

Betsy Greenberg age 3 years. Symptoms were Headache, Vomiting and Sore throat, no rash was noticed, but she was desquamating freely. She was quite unconscious and in violent convulsions, and died 5 hours after admission having passed no ^{u.} urine.

The Autopsy showed an empty Bladder. The Kidneys were large, pale and anaemic - Parenchymatous Nephritis - other organs normal. Diagnosis - Scarlatinal Uraemia.

John Acott age 5 years. Symptoms were Headache, Vomiting, a Typical profuse punctate Scarlatiniform Erythema, an ulcerative sore throat with a lot of exudation on both tonsils. Regurgitation of food and fluids, no Albuminuria, Profuse Nasal Discharge, Suppurative Adenitis on both sides of the neck.

Death occurred on the 20th day of disease. Autopsy - Skin showed the stains of a Septic Rash on Trunk.

Kidneys were of a dark colour and showed lines of congestion at junction of Papillae to cortex.

Lungs showed some Emphysematae.

Heart nothing abnormal except a few recent pale vegetations on mitral valve.

Liver a Typical nutmeg Liver.

Spleen showed Venous congestion.

Pus was present in both Mastoid Antria.

Other organs normal.

Diagnosis. Septic Scarlet Fever.

Florence Mayhew age 3 years, Symptoms were Headache, Vomiting, Sore Throat and profuse rash. The urine showed clouds of albumen but no blood was ever seen to be present.

Suppurative Adenitis of the neck which was incised twice.

A persistent Double Otorrhoea and a profuse and offensive nasal discharge. There was Ulcerative Stomatitis, and the Palate became perforated and then sloughed away to some extent. There was marked Regurgitation of food so that nasal feeds were necessary. A marked Purpuric Rash occurred on the 36th day of disease well seen on abdomen and chest. This changed colour slightly in the usual way that extravasated blood does but was still very evident on the 41st day of disease when death occurred.

Autopsy - The Haemorrhagic Rash was still evident, blood being extravasated under the cutis vera.

Soft Palate was sloughed.

Tonsils ulcerated.

Pus found in both Mastoid Antria.

Heart dilated.

Kidneys were enlarged, pale and haemorrhagic.

Liver was fatty.

Other organs normal.

Kate Little aged 5 years. Symptoms were Vomiting, Headache and a Scarletiform rash. All the glands of the body were markedly enlarged. A Brawny swelling formed in the Lumbar Region in the middle of the back. A large subcutaneous slough formed but no suppuration occurred and the slough was easily extracted with a lot of oily serum, leaving a cavity 8 inches square.

The head became markedly retracted from Septic Spinal Meningitis and 3 Metastatic swellings occurred on the wrists and legs just before death which occurred on the 32nd day of disease.

Autopsy - The Stains of a Blotchy rash were still evident.

The Lungs showed some Emphysema.

Heart normal.

The Kidneys were a little pale but nothing else was noticed.

A large dry Cavity was seen on the back but did not extend down to the Spinal Cord.

Spinal Meningitis was present.

Pus was present in both Mastoid Antra..

Diagnosis Scarlet Fever and Septicaemia.

I have since seen a large Brawny swelling

occurring in the groin in a case of Scarlet Fever (Alice Cooper) A large Subcutaneous slough forming with oily serum. Such a condition is very like those large sloughs which not so very rarely occur in the neck, undermining the skin, exposing the Vessels and Muscles and is probably almost the same condition.

X
 Buchan reports cases where the apex of Scarpa's triangle showed Gangrene of the skin and
 X
 Welch and Shambery term these cases Dermatitis Gangranosa.

Thomas Emery age 2½ years. Symptoms were Headache, Vomiting, Sore Throat, Scarlatiniform rash and Nasal discharge. A profuse double Otorrhoea occurred on the 10th day, acute Nephritis began on the 19th day and the urine was diminished. Pain occurred over both Mastoids with fits and drowsiness. I performed a double Mastoidectomy, pus was present in both mastoid Antra and free drainage was established. But the fits continued and death took place 4 days later on 32nd day of disease. One considered the advisability of doing something further in the way of exposing the lateral sinus or brain. But as both sides were equally bad with no localising symptoms, it was not thought advisable, and as

X Buchan, Lancet, Oct. 1901 page 915.

X Welch & Shambery. Acute Contagious Diseases. Page 424.

X

Jurgensen states, quoting Hancock, it is extremely difficult to distinguish between a case of Malignant Scarlet Fever, Meningitis and Uremia. And I wish to add from Cerebral Abscess in some cases. One has seen a Cerebral abscess as big as a Pigeon's egg (Case Arthur Fred Jewson) in a bad case of Scarlet Fever with double Otorrhoea and almost complete suppression of Urine, causing no symptoms except slight drowsiness, until $1\frac{1}{2}$ hours before death when the child became seized with violent convulsions, mainly restricted to one side of the body. I show a Photograph of the abscess.

No Autopsy was allowed.

Diagnosis. Scarlet Fever Nephritis Double Suppurative Mastoiditis and further Intra cranial Sepsis

x
Abscess
Cavity



Thomas Hooker, aged 5 years 3 months.

Symptoms. Headache, Vomiting, Sore Throat, Rash, Temperature varying from 104° to 106°, delirious, urine showed Albumen, no Blood, Tonsils almost meeting in the middle line, Ulcerative Stomatitis, Bed-sores, profuse Nasal discharge.

Death on 7th day of disease.

No Autopsy allowed.

Diagnosis. A Septic Scarlet Fever with Pyrexia.

Charles Henry Clifton age 2 years 10 months.

Symptoms were a Scarletiform rash, Ulcerative Sore Throat, Ulcerative Stomatitis. Profuse Nasal Discharge. Also there was a well marked Broncho Pneumonia with a high temperature.

Death occurred on 3rd day of disease, 24 hours after admission.

No Autopsy allowed.

Diagnosis. Septic Scarlet Fever and Broncho-Pneumonia.

Chapter II.

Complications.

Nephritis is by far the most important of Scarlatinal complications, on account of the frequency of its occurrence, and the frequency with which it affects the after-health of the individual seriously interfering with his ability to contend with the stress and labour of life.

In dealing with Scarlatinal Renal changes one has thought it advisable to divide them up into 4 distinct types.

This is quite an arbitrary classification, as one type so often verges or changes to another. But this seems to be useful as a clinical classification.

The 1st Type is where there is a slight trace of Albumen in the urine during the first few days of illness, one has termed this form Pyrexia albuminuria as so often it entirely disappears when the temperature drops. ^X Friedlander has chosen for this form the name "Initial Catarrhal Nephritis."

The 2nd Type contains those cases where a slight trace of albumen is seen in the urine for a short period during the 2nd & 3rd weeks one has termed these cases Temporary Albuminuria.

The 3rd Type is where the Albuminuria lasts for several days or even weeks, but no blood is

present, although often there is a temperature and other symptoms one has termed these cases "Persistent Albuminuria."

The 4th Type contains those cases which have both blood and albumen and one has termed them "True Scarlatinal Nephritis."

Of the 500 cases one finds that 22.6% of the total cases showed albumen in urine at some period of the disease, 23 or 4.6% showed blood and albumen. X
Apparently it has been shown by Bartels, and E. Wagner that in certain epidemics Nephritis may, almost or even altogether fail to appear. Certainly there is a great difference of opinion as to the exact frequency of its occurrence. X
Steiner estimates the variations as from 5 - 70%. Vohamnesen in the Norwegian reports goes up to 90%.

7X
Dickinson states half the cases of Scarlet Fever showed Albuminuria. Quoting the late Dr. 8X
Hillier Girard of Paris found Albuminuria in more than half of his cases although only 4.55% showed true Nephritis which is like the normal London experience.

- X
- X Nothnagel Page 545.
- 7X W.H.Dickinson Allbutts System of Medicine 1897 Vol. 14.
- 8X Dr. Jules Girard Syndrome Infectieux Tardef au cours de la Scarlatine 1900

The Metropolitan Asylum Board's reports for last three years shows a diminishing amount of albumen and Nephritis.

5.37%	Nephritis	and	13.01%	Albumen	in	1903.
4.27%	"	"	11.78%	"	"	1904.
3.25%	"	"	9.23%	"	"	1905.

X

Again Sorensen states that "More or less considerable inflammatory tissue-changes may be present in kidney without causing evident or discoverable symptoms, that the clinical symptoms of Nephritis appear much later than the anatomical changes take place in some cases. Further Professor G. Dieulofory describes what he calls "La Dissociation des Actes Morbes du Rein". Speaking of Scarlatinal Nephritis he says, "Here again we find the dissociation of the morbid actes of the kidney. On the one hand Albuminuria lasting for years without the coincidence (adjunction) of any other symptoms, and on the other hand symptoms of Brightisme with or without the coincidence of Albuminuria." After such statements it is difficult to say how often Renal changes really do occur in Scarlet Fever. Certainly they vary in severity enormously; one may only find the slightest amount of Albumen in the urine lasting only a few hours or on the other hand one so often sees a Nephritis of a most severe and serious nature.

Therefore my statistics as to the frequency of Nephritis 4.6% compares very favourably with Gerard of Paris and the Reports of the Metropolitan Asylum Board.

But the occurrence of Albuminuria in 22.6% of the cases is considerably more than is usual in the Metropolitan Asylum Board reports. But one must remember that my figure includes those of Pyrexia or initial catarrhal nature which were 5.2% of the total. And again the Metropolitan Asylum Board reports include the cases for a whole year whilst mine only considers those that occurred in the winter, and ^X Fowler has stated that Forchheimer has shown that kidney troubles are most frequent in the summer months and states positively that Nephritis does not seem to be produced by catching cold.

The first part of this statement is probably right as Rheumatism Puerperal Fever and Erysipelas are most common in years of small rain fall, and these diseases are all supposed to be of a Septic nature and of a Bacteriological origin closely allied to Scarlet Fever.

Upon the 2nd part of the statement it is difficult to express an opinion, perhaps the fact that wards in the winter months are usually kept at a more even temperature than in the summer months

may have some influence.

Type I.

Of the 133 cases of Scarlatinal Albuminuria, there were 26 cases of the Initial Catarrhal or Pyrexia Type (5.2% of the whole 500 Cases) Of these 23 cases cleared up entirely during the first week. The 3 others were more persistent.

Pyrexia Albuminuria is not to be considered as a condition belonging only to Scarlet Fever. One sees it frequently during the fastigium of any acute febrile condition and it passes off as the temperature subsides. It has been said that it is due to changes in the protoplasm of the Glomeruli; interfering with the power of the Epithelial cells in preventing the passage of Albuminous substances from the blood stream. Anatomically one ^X finds a moderate Hyperemia of the Kidney with a slight degree of a cloudy swelling of the Epithelium of the convoluted tubules. The Epithelium here and there shows marked proliferation and later is cast off entirely. Occasionally granular or Hyaline and Epithelial cells are seen within the Kidney. Tubules.

Type II.

57 cases or 11.4% of the total had Albuminuria during the 2nd & 3rd weeks which was very slight

in amount and disappeared in a day or two. It never lasted more than a week in these cases. There were no constitutional disturbances and the normal course of the disease was in no way altered in these cases.

Type III.

27 Cases or 5.4% of the total number had Albuminuria during the 2nd & 3rd weeks which was of a more severe and prolonged nature. These cases often showed well marked constitutional disturbances a well marked rise in the temperature. Puffiness of the face, pains in the back, swelling of the glands, vomiting, slight rigors and the urine was often diminished in amount, and of high Specific Gravity.

Some of these cases were very severe indeed and 2 as has been stated ended fatally.-

(Thomas Hooker and Florence Mayhew) But one must remember that there were other complications present which also greatly helped in bringing about a fatal termination.

X

But as Dickinson has said in his monograph on albuminuria in reference to Scarlatinal Nephritis, "The worse cases are often those in which no blood makes its way into the urine."

Type IV.

23 Cases or 4.6% of the total number had definite true Scarlatinal Nephritis with blood and Albumen in the urine. These cases were always accompanied with the usual constitutional disturbances of Nephritis, as Pyrexia, Vomiting, Rigors, Chilliness, sometimes Oedema and scanty urine. Besides, one often noticed, and in fact more than half the cases complained of Sore Throats at the onset of Nephritis, and on examination one found a definite Pharyngitis with reddening of the fauces and swelling of the tonsils, sometimes with exudation, also there was present in 21 of the 23 cases a definite cervical adenitis which was of a severe and intense nature in 15 cases. There being a marked swelling of the Anterior Cervical glands which were tender to the touch and required treatment. This Adenitis in most cases rather preceded by a few hours than accompanied the onset of the Nephritis.

Hence one infers that swelling of the Cervical Glands with or without a slight soreness of the throat, during convalescence, is to be regarded as the first danger signal to a commencing Nephritis. And it is necessary to treat such a condition by aiding the kidneys in removing the toxic ^{bodies or toxins} from the body which can be attained by means of Saline purges.

Diuretics, Bland fluids, or even pure water, as is recommended by Barr of Leeds, with absolute rest in bed. Also the Throat and Cervical adenitis require local treatment. By this means one has been able to abort a commencing Nephritis.

The Microscopic examination of the urine during the acute stage of Nephritis shows, Red Blood corpuscles and Blood & Epithelial Casts just as one would expect. Later Hyaline and Granular casts with Epithelial cells & Leucocytes were seen. In the transient cases with slight Albuminuria no casts were seen; but in the more persistent cases with a larger deposit, one found on boiling and acidulating a few granular and Hyaline casts.

Day of Incidence.

Apparently Albuminuria may begin almost at any period during the first three weeks. Usually during the third week it makes its appearance. Blood is seldom seen in the urine until after the 14th day. Below is given a chart of the number of cases that began to pass Albumen on each day. Also when Blood was first passed and in the cases of true Nephritis the two are given together below. Usually a day or

so intervenes between the beginning of Albuminuria and the onset of Haematuria. Pyrexia or initial Catarrhal Albuminuria is not included in the table.

Day of) Disease)	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32				
Albumen) first) appeared)	1	3	3	9	3	7	5	5	2	3	2	11	4	7	5	2	9	3	3	0	1	2	1	1						
	92 Cases in all																													
Blood) first) appeared)				1	1			1		1		7		3	4		1			1	1		2							
	23 Cases in all.																													
Nephritis) Cases.) Day of) appearance) of Albumen) & Blood.)	alb.....B.....											Alb.....		B		Alb..	B												
												Alb		A																
												&		&																
												B		B																
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	Alb.....										B																		
	Alb.....																													
	Alb.....											B																		
	Alb.....											B																		
	A	A			A							A&																		
	&	&			&							B																		
	B	B			B							Alb.....	B																	
												A																		
												&			Alb.....															
												B																		
												Alb.....	B		A&	A&														
												A	A		B	B														
												&	&																	
												B	B	19 cases in all																

Hence one sees that most renal complications begin between the 18th & 23rd days of the disease, but may begin earlier or later, although it is rare to find them beginning after the 30th day.

ETIOLOGY OF SCARLATINAL NEPHRITIS.

The frequency with which a severe Adenitis, with a Pharyngitis preceeds; or accompanies the Renal disturbances in Scarlet Fever, has led me to suspect that there is some close relation between the two inflammations. It seems to back up the theory that Nephritis is of a Micro-organismal nature, and that the Adenitis and Nephritis are both of the same origin. Again, the frequency with which one gets apparent outbreaks of Nephritis in Scarlet Fever wards seems to back up this theory.

The exact Glands which become swollen in this condition are the Anterior Cervical Glands in front of the Sterno Mastoid, namely the Submaxillary Lymphatic Glands and the upper set of the deep Cervical Glands.

The Sub mental, Post Cervical, and parotid Lymphatic Glands do not enlarge in this condition, as they receive lymphatics from a different area.

The Sub Maxillary and upper set of the deep Cervical Glands^X according to Sir Fredk. Treves, receive the lymphatics from the Post part of the tongue, the Buccal Cavity, the tonsils, palate, parts of the Nasal Fossa and upper Pharynx.

X Treves on Scrofula and its Gland diseases.

Now it is these parts, especially the Tonsils, which are primarily affected in the onset of Scarlet Fever and are again seen to inflame at the onset of a Renal Inflammation. Hence one has looked for the cause in these parts. Throat cultures were taken during the 3rd week in 50 consecutive cases of Scarlet Fever and in 25 Cases one found a Streptococcus in large numbers, often almost a pure culture was obtained. They usually were in long chains and appeared to have the cultural and Morphological characteristics of Strepto Coccus Conglomeratus which will be fully described later.

It is important to take the culture towards the end of the 3rd week (from 20 in. 27 in. day) as it is then that one most frequently finds a Streptococcus of this nature.

I have only succeeded once in obtaining a Strepto Coccus of this nature straight from the Kidney in a fatal case of Scarlatinal Nephritis. In four other such cases I easily obtained an abundant and rapid growth of Staphylococcus. In five others no growth was obtained. Strepto Cocci have been found in the Kidney in Scarlet Fever by Gordon Raskin Guinon and Babes. Gordon found Streptococci in 6 out of 10 fatal cases inside the Kidney and in one a few Streptococci were seen in situ. In

two cases Staphylococci were found. Probably the reason why I have not succeeded in finding Streptococci in the Kidney more often, is that one has the greatest difficulty in getting them to grow, whilst Staphylococci grow with the greatest ease, and certainly are often to be found in Scarlatinal Kidneys. I took great precautions not to make fallacies by getting the cultures contaminated from other sources. The Kidneys were removed straight from the body and then incised by a Red hot knife and cultures immediately taken with a platinum needle; from the centre of the Kidney in the usual way, and there was often a luxuriant growth of Staphylococci within eight hours.

But in spite of the fact that Staphylococcus is undoubtedly present within the Kidney in these cases one is still inclined to think that Streptococcus is also present. The two as is usual in most Septic conditions do their work together; and of the two probably Strepto-Coccus does the greatest mischief and is the most important especially as one has definitely shown that the opsonic index against Strepto-Coccus is so low in Scarlatinal Nephritis.

X

Forchheimer contents himself by saying,
"For the present the observation holds good that in all those cases in which there exists an extensive

Streptococcal infection we are more liable to have Nephritis than in those cases in which the Scarlet Fever is alone Operative."

Also in those cases in which Suppurative Cervical Adenitis occurred, one found Strepto Cocci present in 8 out of 10 cases while Staphlococci were seen in all the 10 cases on cultivation of the pus.

Hence one is inclined to think the infection enters through the Adenoid tissue of the Buccal Cavity and from there is carried in the lymph stream to the Cervical Glands causing the severe adenitis so often seen. Thence it is carried in the Blood Stream to the Kidneys.

Now the question arises: Why does one case develop a Nephritis while the next one does not? I have definitely shown that Strepto-Cocci are usually to be found in the throats of convalescence Scarlet Fevers during the 3rd and 4th weeks. Probably it is because they cannot enter the system as there is not an open gateway, and if a few manage to get into the tissues they are eagerly devoured by the Phagocytes! But once the resistance of the body is lowered or a more open gateway is prepared they eagerly enter and cause trouble. This must be so as it is a well known fact that many of the Pathogenic Bacteria as Pneumococcus and Diphtheria Bacillus are often present in the mouths of perfectly

healthy people causing no disturbance to the health of the individual.

X
A German Investigator has isolated over 60 different Microorganisms from the Buccal Cavity and Sputum of a healthy man, of which many were of a Pathogenic nature. The frequency with which one finds Klebs Löffler Bacillus (B. Diphtherial) in the throats of Scarlatinal Cases with no evidences of Diphtheria is another very interesting proof of this fact.

Probably the Klebs-Löffler Bacilli are present in the throat in some cases before the onset of Scarlet Fever, and only develop after it has run its course so weakening and lowering the resistance of the patient. Hence one frequently meets with Post Scarlatinal Diphtheria in cases where it is difficult to see where the infection arises. An interesting case of this nature occurred when this Hospital first opened and everything was quite new and clean. During the first few weeks after the opening, only Scarlet Fever was admitted and a case of Post Scarlatinal Diphtheria developed in a child who had been in Hospital over five weeks. Now there had never been any cases of Diphtheria in this hospital then, and no strangers had seen the child. So in all probability the child must have been admitted with the infection lying dormant, and what is

greater proof of this is the fact that the mother had two other children who were admitted to other separate hospitals under the Board. And here again Post Scarlatinal Diphtheria developed after the Scarlet Fever had run its course.

This is comparable to an experiment performed by ^X Metchinkoff. He found that if he inoculated a perfectly healthy dog with a certain strain of anthrax, no infection occurred. But if he previously inoculated the same dog with Rabies so lowering its power of resistance and then inoculated it with the same anthrax it rapidly succumbed long before the period of incubation for the Rabies was at an end.

Just because one finds Diphtheria Bacilli in the throat the individual has not necessarily Diphtheria. Yeast will grow in water and cigar ash without producing alcohol. Also Diphtheria may grow without producing Toxines or it may be that they are not absorbed into the body. The same may apply to Strepto Coccus in convalescent Scarlet Patients.

Now what is it lowers the power of resistance or opens the gateway to the infection in Scarlatinal Nephritis. One has heard a lot of

chill and cold as being the cause and hence it is advised to keep all Scarlatinal Patients in bed for a long time to avoid Nephritis.

But apparently this does not diminish the amount of Nephritis, and some have claimed that there is no danger on getting Scarlatinal patients up early and have shown Statistics to this effect. Certainly a chill will lower the resistance of any individual but beyond this one does not like to go.

Probably a most important factor is anything which will predispose the tonsils and fauces to a secondary inflammation.

Now the anatomical and Morphological shape of the tonsil in some throats predisposes it to a secondary inflammation. If the tonsil is large hypertrophied and pitted, with deep fissures and cracks, it is very easy for particles of food to remain in these fissures, and as the Buccal Cavity is swarming with Bacteria, the decomposing particles of food become hot beds for the cultivation of germs. Very soon the substance of the tonsil becomes infected and a secondary Tonsillitis is set up and so the Bacteria gain admission to the system. This fact has led me to examine carefully in 303 cases the exact anatomy of the tonsil and one is greatly struck by the close relation which apparently exists between the anatomy of the Tonsil and Scarlatinal Nephritis.

Speaking generally those cases with large and fissured Tonsils appeared to be more liable to Nephritis than those with small flat and smooth tonsils.

In these 303 cases each throat was examined at least three times on separate occasions during the first 3 weeks of illness, as one found a single examination to be inaccurate on account of temporary swelling of the tonsil, which was often covered with exudation during the first few days of the disease and could not be easily seen. I shall describe the Tonsil in four distinct anatomical groups:-

Group I. includes those cases where the Tonsils were small often retracted and smooth and I find there were 63 such tonsils in the 303 cases.

Group II includes those cases where the Tonsils were only very slightly pitted or fissured, and there were 114 cases in which the tonsils were of this nature.

Group III includes those cases where the Tonsils were decidedly fissured or pitted and often swollen. Also those cases where a deep Supra Tonsillar fissure was present were included in this group and there were 94 such tonsils.

Group IV includes those cases where the fissures were very deep indeed. The tonsils often being Hypertrophied and very ragged in appearance. There were 32 cases where such conditions were present.

Therefore to conclude of the 303 Cases one finds that

63 had smooth Tonsils.

114 had slightly fissured Tonsils

94 had fissured Tonsils

32 had deeply fissured Tonsils

Total 303 -

Now amongst these 303 cases there were 21 cases of Scarlatinal Nephritis and of these 12 Cases had Tonsils which were deeply fissured (Group IV) and of the type which was most likely to inflame. 7 of these cases had tonsils which were fissured and come under Group III. 2 of these cases had smooth tonsils.

But both these latter cases had Cardiac conditions which if not causing the Nephritis would greatly predispose to it, and so may account for it. Therefore of the 32 Cases which had deeply fissured Tonsils (Group IV) 37.5% developed true Nephritis which is a very big percentage.

Turning to the cases of Albuminuria in the 303 Cases, there were 18 Cases of Persistent Albuminuria (Type III) and of these 5 had deeply fissured Tonsils (Group IV) 7 had fissured Tonsils (Group III).

6 had slightly fissured Tonsils (II)

0 had smooth Tonsils (Group I)

In the 303 Cases there were 36 Cases of Temporary Albuminuria (Type II) and of these

8 had deeply fissured Tonsils (Group IV)

6 had fissured Tonsils (Group III)

15 had slightly fissured Tonsils (Group II) and

7 had smooth Tonsils (Group I).

Therefore one sees this same fact well marked in the cases of Scarlatinal Albuminuria although not quite so evident in those cases where the Albumen was not of a very severe nature.

Therefore I consider it advisable to continue the routine cleaning of the Throat in all cases of Scarlet Fever by the usual methods, long after the acute symptoms have subsided so as to lessen the chance of a Secondary Pharyngitis.

X

But of late Hunter has laid great stress upon the importance of Dental Caries in various diseases and Godlie and Roughton have shown the curious remote affects which are frequently associated with Dental diseases.

X

Apparently Teeth are not of so great importance in Scarlet Fever as regards renal complications.

X Hunter - oral Sepsis - British Med. Jour. Feb. 24th 1904.

X Lancet Dec. 5 1905 P. 1551.

But as it is well known several bad stumps in a mouth will predispose to a cervical Adenitis and Tonsillitis. Hence such a condition is of great importance in Scarlet Fever.

Therefore I have carefully examined the condition of the teeth in 400 Cases of Scarlet Fever and I find that there were 208 Cases where the teeth were all sound (good) and of these 12 Cases 6% developed Nephritis and 24 Cases 12% developed Albuminuria. (These Statistics do not include Pyrexia Albuminuria).

There were 101 Cases where the Teeth were fairly good only one or two at the most carious. And of the cases 7 cases or 6.9% developed Nephritis and 24 Cases (13.7%) cases developed Albuminuria.

72 Cases where the Teeth were decidedly bad several being carious, and of these cases 5 cases (or 6.95%) developed Nephritis and 10 (or 13.88%) developed Albuminuria.

14 cases where the teeth were very bad indeed, several loose stumps being present after which considerable Pyorrhoëa alveolaris and inflammation of the soft parts. And of these one case or 7.1% developed Nephritis and 2 cases or 14.2% developed Albuminuria.

Therefore one finds that the percentage of cases that develop Nephritis and Albuminuria is only

slightly raised by the teeth being bad.

Viz. -

	<u>Teeth Very Good</u>		<u>Teeth Very Bad.</u>
Nephritis	6%	raised to	7.1%
Albuminuria	12%	raised to	14.2%

In these 400 Cases.

ADENITIS.

X

In 1872 Harley studied the post mortem changes in 28 cases of Scarlet Fever and concluded that it was a disease of the Lymphatic System characterized by Hyperplasia of the Lymphatic Glands, Spleen Tonsils, liver and other Lymphatic structures of the body. He therefore proposed to substitute for the name Scarlet Fever the term Lymphatic Fever.
X
Pearce and Klein have also described the increase of Lymphatic Tissue in the body and have both made Histological studies of the glands.

I found that 388 or 79.6% of the 500 Cases showed definite enlargement of the anterior cervical glands at some period of the disease.

216 or 43.2% had swollen glands on admission and I have termed these cases early Pyrexia Initial or Catarrhal Adenitis. Of these cases in 154 the

X Med. Chir. Trans. Lond. 1872 1 x P 102.

X Welch & Shamberg. Acute Contagious Diseases P.441.

glandular swelling rapidly disappeared when the throat cleaned and the acute stage was past. But in 36 Cases the glands remained swollen for a considerable time; whilst in 26 Cases they became much worse and required further treatment during the 2nd and 3rd weeks.

172 Cases although not having an adenitis at the onset of the disease showed considerable swelling during the 2nd and 3rd weeks and I have termed these cases late adenitis in contradistinction to the initial Catarrhal Variety. In 18 of these cases the symptoms were very intense with great swelling; 8 of the total number of cases went on to Suppuration (Suppurative Adenitis) and required an incision. Hence one concludes that adenitis is extremely common in Scarlet Fever although Suppuration is comparatively speaking rarely met with.

One has found that it is extremely important to begin the treatment of Adenitis as early as possible, as when the later stages of Adenitis are reached we get the stage of Stasis and subsequent Thrombosis and Necrosis, and now Hot Fomentations would help the abscess formation. I personally much prefer to treat Scarlatinal Adenitis by Ice Bags.

In 40 cases of Intense Scarlatinal Adenitis 20 cases were treated by Hot Fomentations and of these 7 cases suppurred while 20 Cases were treated by Ice Bags and of these only one suppurred and

here the ice bag was not used from the very beginning. In fact, I have never seen a case to suppurrate where the bag was applied at a very early stage.

One has thought it necessary to have a special India Rubber Ice Bag made to fit the neck comfortably, as there did not appear to be an efficient and suitable Ice Bag on the market for this purpose.

SCARLATINAL OTITIS.

Under this term I wish to include the various inflammatory changes which occur in the ear and mastoid cells. The first symptoms which lead one to suspect some inflammatory changes taking place in the ear, are pain, slight rise of temperature, drowsiness followed by otorrhoea, and I find that of the 500 cases, 47 cases or 9.4% developed otorrhoea. This figure is a much lower percentage than is often given.

X

Gordon in the Monsall report says it occurred in 22% of the total cases of scarlet fever. He states definitely that he lowered the percentage by 6% to this figure by instituting a routine method of irrigating scarlatinal throats with plain water from a douche can $1\frac{1}{2}$ ft. above the patients nostrils. One is inclined to think the struggling, coughing retching and even vomiting, which is sometimes caused by this method, especially in children, will often drive septic material down the Eustachian tube to the ear. I am inclined to think that swabbing with perchloride of mercury in Glycerine (1 in 1000) which is a non-irritating and very efficacious antiseptic, is much safer; where these difficulties are present, although sometimes damage is done to

the soft parts and even to the teeth, by clumsy swabbing, also the risk of mercurial poisoning must be thought of.

Douching certainly does clear any loose filth out of the mouths, and so is extremely efficacious. Of the 47 cases of otorrhoeas 36 or 7.2% of the total were double otorrhoea. Both ears being involved much more frequently than one as X Burckhardt-Merian states. Of the 36 cases 14 disappeared rapidly under treatment while 22 persisted for a longer period. Of the 9 single Otorrhoeas 4 were merely due to a slight temporary inflammation of the external auditory canal and here the membrana Tympani was not perforated. Such a condition is quite distinct from those cases where the membrane is perforated and we get a true Otitis Media.

There were 43 cases of Otorrhoea or 8.6% of the total number of cases. 5 of these were single Otorrhoeas, the remaining 38 cases were double otorrhoeas. It is often extremely difficult to see the perforation in acute cases, as one has great difficulty in removing the discharge so as to expose the membrane thoroughly.

X Burckhardt-Merian.

"Über den Scharlach in Seinen Beziehungen zum Gehörorgan" V. Volkmanns' Sammlung, Kleinseher Vorträge Chirurgie Ur 54.

Three of these cases showed definite symptoms of the mastoid antrum becoming involved, and I considered it necessary to perform the operation of anthrectomy. Two of these cases recovered whilst the third where it was necessary to open both mastoids succumbed (Case Thos. Emery) as has been stated.

Apparently it is not so frequently necessary to perform this operation which is not without risk, as is often advised. Many Otorrhoeas get quite well under ordinary irrigation treatment.

X
But Gordon of Monsall advises early operation to prevent deafness and other complications. He does this operation three times as often as it is performed in this hospital. In 340 cases of Otorrhoea he operated in 62 cases or 18% whilst it was only necessary to operate in 6.3% of my cases.

Apparently there is a great deal to say for his method of procedure in that one frequently finds:-

Pus in the mastoid antrum when there are no signs of Otorrhoea, or other symptoms. I have carefully examined the mastoid cells in 8 fatal cases of Scarlet Fever, without a previous history of Otorrhoea and found Pus in six cases. One must not mistake the normal gelatinous grumous fluid which the antrum contains for pus. Slides & cultivations were

made in all these observations and were only put down as Pus, when definite pus cells and cocci were present. Of these cases 3 showed definite chains of strepto-cocci often resembling streptococcus, conglomeratus. Staphylococci and bacilli were usually also present.

Hence Gordon may be quite right, in that it has always been taught, that "where there is Pus, let it out". Nevertheless many of these cases apparently dry up without operation.

Wilde's incision was made through the periosteum behind the ear in 8 cases and in only one case was it necessary to perform a further mastoidectomy.

The reason why this incision so often does good in cases of Otitis Media is that there is a free communication between the mastoid cells and external vessels, the bone over this area is perforated with many small holes transmitting lymphatic and blood vessels. Hence by this means a considerable amount of drainage is obtained and the tension is relieved, also the action as a counter irritant is extremely efficacious. These perforations account for the frequency with which one meets with a subperiosteal abscess, or suppuration of the mastoid lymphatic gland. The infection having spread from

44

the interior by these channels, These small holes which appear as dots on removing the periostium will serve as yet another guide to the antrum in performing an anthrectomy, and one is almost safe to strike the antrum if he perforates the bone "well in amongst the Dots".

As regards the Bacteriology of Aural Discharges, I found Streptococcus present in 7 out of 24 cases which I examined, Staphylococcus in 17 out of 24 Cases. Often there were Streptothrices, other cocci, and Bacilli present. Also one found a peculiar Diptheroid Bacillus present in 12 out of 24 Cases or 50% of the total cases examined.

X

Dr. Galbraith Connal records a case of Primary Diptheria of the external Auditory Canal upon which he successfully performed the radical operation of Otitis Media. As far as one can gather from his article and subsequent letters, he made the diagnosis of Diptheria entirely by the microscopic appearances of the Bacilli found. And as P. Watson Williams states even if the culture from the swabs yielded, Morphologically typical Diptheria Bacilli;

X British Med. Jour. Jan. 19th.07, P. 139.

X British Med. Jour. Jan. 26th.07, P. 232, and Feb. 9th.07, Page 347.

one must hesitate to accept that alone as sufficient evidence of a Diptherial Infection unless further cultural tests were employed.

As Dr. A. E. Porter states, one frequently finds Bacilli indistinguishable morphologically from true Diptheria Bacillus in the external auditory meatus; both of Scarlet Fever Patients with Aural Discharge, and of healthy persons. As has been stated, I found a Diptheroid Bacillus of this nature in 50% of the Scarlatinal Otorrhoeas examined. It is probably the microorganism which has been termed Bacillus Auris owing to its Habitat, and is like the diptheroid Bacillus (B. Xerosis) found in normal eyes. Below is a micro photograph of an almost pure culture of this organism. It is a very bad photograph. It can be distinguished from the true Klebs-Löffler Bacillus in that it does not acidify Glucose Broth, as B. Diptheria does. It is not possible to distinguish it microscopically

(B. Xerosis)

One is inclined to think that the importance of this Bacillus has been overlooked by most observers. As twice in some 8 examinations I have found it in large numbers in the Pus of a Septic Mastoid Antrum. And on one occasion I obtained

almost a pure culture of this Bacillus with a few Streptococci from a secondary Cerebral Abscess (Case Arthur Fredk. Jewson)



This photograph shows a Diptheroid Bacillus which is not quite in focus. It shows the Granular staining and its parallel arrangement.

Otorrhoea usually begins fairly early in Scarlet Fever, and rarely is seen to begin after the 4th week. Below is a table giving the number of cases beginning on each day.

Day of)																
Disease)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	

Number of)																
Cases that)																
commenced)																
on each)	1	2	1	1	1	1	2	3	5	2	3	2	3	1		

Day of)																
Disease)	16	17	18	19	20	21	22	23	24	25	26	27	28	29		

Number of)																
Cases that)																
commenced)																
on each)	1	2	0	1	0	2	1	0	0	1	1	0	1	1		

RHEUMATISM.

It has been said that Scarlatinal Rheumatism is entirely different from a true acute Articular Rheumatism and Trousseau ^X has stated that Scarlet Fever is never complicated by true Articular Rheumatism. Now that there is a possibility that Acute Articular Rheumatism stands in close relation to the entire group of affections caused by pus - producing organisms, the subject becomes more and more worthy of discussion. One great point to be said in favour of the two conditions being of the same nature is that people who have once had acute Rheumatism are most likely to have a return during an attack of Scarlet Fever. This was well seen in several of my cases especially in the case of (Nellie Shillcock) who had a very bad multiple Arthritis.

^X The same point seems to apply to Nephritis Again Endocarditis and even Chorea may occur in Scarlet Fever. I have often seen the former.

Also in one case, a girl of 18 who had Purpura Rheumatica for some years, this Rheumatic manifestation was seen to get much worse under the influence of the Scarlatinal Toxin. Both these

X Nothnagel. Page 538.

X Nothnagel. Page 538.

forms of Rheumatism yield to Salicylates, and there were only 2 cases out of 50 which did not disappear after one week's treatment.

The usual symptoms are - pain, stiffness, slight swelling, and sometimes redness. I agree thoroughly with Trousseau ^X who states that Scarlatinal Rheumatism is usually mild and of short duration, is commonly localized and, when it disappears it does not tend to return again. Apparently in different epidemics it shows a remarkable variation in the frequency of its occurrence. Rheumatic pains in the joints seem to have some relation to the Menstrual period in women. They often began and subsided with the incidence and cessation of this function.

50 cases or 10% complained of Rheumatism at some period of the disease. This is rather more frequent than Koren in Christiania described. He found it in 6.3% cases while ^X Ashby of Manchester found it in only 2% of the cases.

36 cases showed only slight temporary pains at the onset of the Fever with no serious constitutional disturbances.

11 were more persistent, with some Pyrexia and often swelling of the joints.

3 showed definite heart complications with

X Welch & Shamberg Acute Contagious Diseases P.419

X British Medical Journal 1883. 11. P. 514.

the development of Bruits.

Rheumatic complications usually occur during the 1st. 3 weeks of Scarlet Fever and are rarely seen after the 3rd. week.

Below is a table showing the number of cases that began on each day of disease.

	Day of Disease.																									
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15											
Number of cases that began.	1	3	5	3	5	3	2	2	0	2		1	1	1	2	1										
	16	17	18	19	20	21	22	23	24	25	26.															
Number of cases that began.	0	1	0	1	1	0	0		1	0	0.															

36 cases in all.

RHINITIS, RHINORRHOEA & OTHER COMPLICATIONS.

Rhinitis.

Of the 500 cases 69 or 13.8% developed this complication. 51 of these cases cleared up rapidly under treatment whilst 18 persisted for a longer period. 69% of these cases were in children under 8 years of age. This complication is much more rarely seen in adults; it is not serious so far as the individual is concerned, except in those cases where Nasal Diphtheria is the real complication.

Nasal discharges are of great importance as a method of infection so causing return cases.
X
Cameron found in 688 "Return Cases" of Scarlet Fever which he investigated Rhinitis or Nasal Discharges were present in 52.3% of the Infecting Cases and Otorrhoea in 8.3%, after the patients had returned from hospital.

Simpson found these conditions present in 76.6% and 14.4% respectively; in 90 cases which he examined.

Cameron has shown that out of 4,000 cases discharged from Gore Farm, the convalescent hospital for this institution, the return cases were:-

X A.K.Cameron Medical Investigation to the Metropolitan Asylum Boards. Report re Return cases of Scarlet Fever and Diphtheria for the 3 years 1902-03-04.

1.6 in cases free from discharges and 2.4 in those suffering from these conditions which were notified to the Medical Officer of Health for Supervision. Hence it is of the greatest importance not to discharge patients until all discharges have ceased.

As regards treatment of nasal discharges one has used a strong solution of Sodium Salicylate with great success as a nasal douche. The routine method here is a douche of Boric Alkaline Solution or a Saline Solution.

One has found that occasionally although the Discharge becomes clearer and less purulent by this latter method, often it seems to persist longer. A little zinc ointment applied to the anterior nares often is quite sufficient as the condition tends to abate when the general condition of the patient improves.

There were 2 cases in which there was a Vaginal Discharge and in one case (a boy) there was a marked Urethral Discharge. All 3 cases were in children.

Neissers Gonococcus was not present in either of the discharges, although there were some intra cellular organisms in the Urethral Discharge, besides chains of Stripto-Cocci. One case (a man) had Gonorrhoea and here Neissers Gono-Coccus was found.



In 30 of the cases Systolic Bruits were heard in the Mitral Area, whilst 3 had Aortic bruits.

X
Mc.Collom states that in 1,000 cases of Scarlet Fever a mitral Systolic murmur was detected in 187. A much larger percentage than in my cases; but certainly mitral bruits are of common occurrence. They are probably due in many cases to a lack of Tonicity of the heart muscle as a result of the X
Scarlatinal poison. Again Von Jurgensein states that endocarditis of the cardiac wall is of more common occurrence in Scarlet Fever than Valvular involvement.

There were no cases of Pericarditis in this series although I have seen cases often occurring in Scarletinal Nephritis. This complication, on account of the high blood pressure and tension, predisposes to Cardiac complications. } 5 Pericard

X
There was one case (Nurse Brown) where Erythrocardia was present causing unpleasant symptoms. It entirely disappeared soon after convalescence.

4 Cases developed Broncho-Pneumonia and 1 case had a definite Lobar Pneumonia. 5 cases developed Pleurisy and in one, an adult male, there was an effusion, and 32 ozs. of fluid were drawn off. It was highly albuminous and on cultivation showed

some Strepto Cocci besides other organisms. 3 cases developed Jaundice which disappeared rapidly under treatment.

9 cases: All children developed septic fingers with pus formation. This complication is due to the children picking their noses and mouths, especially in Septic cases. It is prevented by the use of gloves and splints.

Abscess formation only occurred in 3 cases not included in Cervical Adenitis.

3 cases were complicated by burns which were treated by Picric Acid. They were apparently undoubted cases of Scarlet Fever, although one has seen an Erythema from the Septic Absorption of a burn or a Surgical wound, sent into hospital as a case of Scarlet Fever. These cases were not of unusual severity and showed no peculiarities.

There were three cases of Surgical Scarlet Fever. Two after the operation for Appendicitis and one after the removal of a Perineal Sarcoma in a child. These cases again showed no peculiarities and were not of a very severe type.

Only one in the series showed involvement of the Larynx but this was of a slight variety and soon passed off under treatment. The rarity of appreciable Laryngitis, apart from coincident Diphtheria, in a disease where Pharyngitis is so common is to be wondered at: but as Trousseau states "La Scarlatine n'aime pas le Larynx."

Tracheotomy for obstructed breathing is rarely successful in Scarlet Fever. Dr. Birdwood states that out of some 30 cases done during the last few years in this Institution there was only one recovery. These cases usually die of a further spread of sepsis to the wound or lungs.

When the larynx becomes involved Intubation is to be preferred and here, as in Diphtheria, it is much more successful in children over 3 years of age.

Of the last 18 Intubations done in this Hospital, so coming under my observation, there were 6 cases in children under 3 and 4 of these died, 3 of which required a subsequent tracheotomy. One has great difficulty in leaving out the tube in the case of very young children.

- X Trousseau Clinique Medicole de l' Hotel Dieu de Paris. Vol I. Ed. V. 1885.
- X Dr. Birdwood. Late Med. Superintendent of Small Pox Ships now at Park Hospital.
- X Park Hospital Report Statistics. 1906.

Two cases had great swelling of the Tonsils and cervical glands. All swallowing and mouth breathing was stopped. In one case (Ivy Stepto) I successfully performed Tonsilotomy during the acute stages of the disease. I think, as Dr. Birdwood states, that this is the correct method of procedure in such cases. The risk of subsequent septic absorbtion is not so great as one would imagine and it is best to do this operation early.

X
Stomatitis occurred in 7 cases. Burney Yeo states that Potassium Chlorate seems to exert almost a specific influence over this disease when given internally. Certainly its use as a mouth wash is very efficacious, most of these cases improve with almost any antiseptic mouthwash if there are no other complications.

X J. Burney Yeo. A Manual of Treatment on Clinical Therapeutics. Vol. I. P. 9. Ed. 1903.

Chapter 111.

DIFFERENT FORMS OF STREPTOCOCCI.

As most of my observations have been carried out in relation to Streptococci, which were isolated from Scarlet Fever Patients, I shall give a brief description of the most common Streptococci which were found, especially noting those which were used in my observations.

Probably there are innumerable varieties of Streptococci; apparently one never isolates two separate specimens which are exactly alike, but one must remember that these micro-organisms vary considerably when grown on different media and entirely change their microscopic characteristics when the culture becomes old. Nevertheless ^XMuir & Ritche state that there are considerably over 150 different species of Streptococci and Staphylococci, therefore it will be impossible for one to describe all the species.

The most common variety is Streptococcus Pyogenes. It is very slightly larger than Staphylococcus Aureus and forms chains which may contain a large number of members, especially when growing in a fluid medium; as the chains vary considerably in length in different specimens two separate varieties of this organism have been described.

X Muir & Ritche. P. 13.

57

Therefore one recognises *Streptococcus Brevis* and *Streptococcus Longus*. *S. Brevis* is said to be found in the mouth in normal conditions and is without pathogenic properties when tested experimentally. It is said to form an abundant flocculent deposit when grown in bouillon.

S. Longus is in much longer chains and is pathogenic to mice and rabbits. It is said to form a more granular deposit when grown in Bouillon.

There still exists some doubt as to a definite distinction between these two species
X
Marmorek has found that the same *Streptococcus* may grow in short chains at one time and long chains at another, and Kolle has shown that a *Streptococcus* which originally grew in long chains will grow in short chains if repeatedly passed through the body of a mouse. For my own part I have found that each strain tends to keep its own characteristics if grown on the same medium each time. They apparently only change when their surroundings are changed.

Both these varieties of *S. Pyogenes* grow very slowly, producing minute white colonies, on agar or
X
blood serum about the 6th day, according to Newman.

X A Manual of Bacteriology by Muir & Ritche, P. 173.

X Bacteriology & Public Health. Geo. Newman. Page 313.

I have often found definite colonies by the 3rd day. It liquifys gelatine and tends to die out if not frequently subcultured.

They multiply by direct division of the elements; and in old cultures it has been observed that the cocci vary in form and size, (involution forms). This latter fact gave support to the theory that *Streptococcus* reproduced itself by "Arthrospores" or mother cells.

The second variety is *Streptococcus - Pneumoniae* described by Weichselbaum as being present in the sputum of patients suffering from Pneumonia. I have never been able to recognise any organism exactly corresponding to it in Scarlet Fever although one has often seen *Streptococci* taking on a *Diplococcic* form.

Scarlatinal or Streptococcus Conglomeratus.

This third variety is of great importance in Scarlet Fever. It has been stated that it is always associated with this disease, but up to the present no organism has been definitely isolated which fulfils the postulates of Kock in respect to spicificity of bacteria. The organism which appears at present to be the most likely cause of this disease is the *Streptococcus Scarlatinae* of Gordon and Klein and is probably identical with *Streptococcus Conglomeratus* so termed by Kurth. Probably the organisms isolated by Baginsky and Glass are different forms of the same *Streptococcus*.

This organism has been isolated from the Blood, Kidneys, Nasal and Tonsillar discharge of persons suffering from Scarlet Fever in its earlier and later stages. I have only been able to find a *Streptococcus* with all the characteristics of *S. Conglomeratus* once in the Kidney, but it is usually present in the throats of Scarlet Fever patients during the 3rd to 6th week of the disease as has been stated: being present in 22 % of the throats examined by me.

I found that this *Streptococcus* was characterised by the extraordinary long length of its chains, its polymorphic nature and the difficulty

one finds in getting it to grow. Its chains if grown in broth are very long indeed and often show a great tendency to have involuted forms. One often finds in the same culture oval and rod shaped elements almost like spores; besides definite Diplococcic & Bacillary forms. The spore like bodies are very evident in old cultures grown on agar or blood serum, which is contrary to what Newman states. Apparently every transition between a coccus and a bacillus are often to be seen.

I am uncertain as to the exact mode of growth and multiplication of these chains. Some of my slides have shown distinct and definite minute chains of faintly stained cocci which appear to become frayed out from the end or middle of an older chain. At first I thought it was some other organism which had gained admission to the culture, but I disproved this by means of plating out, and subculturing the growth, therefore I am inclined to regard these minute objects as merely young chains. The micro-photographs of the strain which I have usually used in my observations show these microscopic characteristics exceedingly well. It grows with difficulty on all the usual media and tends to die out after 3 weeks artificial growth even if the greatest care is taken in making frequent subcultures.

It forms minute grey and granular looking colonies on agar and blood Serum. It usually coagulates milk and is acid forming. It does not liquify gelatine. When grown in Bouillon it forms masses which tend to sink to the bottom, but float through the media on shaking.

I have never myself been able to see the definite "Bun-like mass" described by Newman and others, but the mass formation was very evident. Kurth has pointed out that when this mass was examined under a microscope a conglomerate appearance was present.

Most of the organisms used in my observations correspond to S. Conglomeratus but on one or two occasions as stated, I have purposely used a strain (strain III) corresponding to Streptococcus Pyogenes and I have chosen a long variety of these species.

All the organisms used in my observations have been cultivated straight from the throats of convalescent Scarlet Fever patients, and I have always used my own leucocytes and in the control observations my own Serum has been taken as normal.

Four Microphotographs of Streptococcus
Conglomeratus as used in my observations (Strain 1)



This Photograph shows an 18 hour growth
in Bouillion of Streptococcus Conglomeratus. Note
the small even chains.

Stained by Pughes Stain



This shows a 3 day culture of the same organism on
Blood Serum. Note the involuted and Spore like bodies.



This shows a 24 hour culture of the same organism on Agar. Note the long chains and Bacillary forms.

Stained by Pugh's Stain.



This shows a 3 days growth in Bouillon of the same Streptococcus. Note the exceedingly long chains, with younger chains faintly stained. Also note Bacillary and involuted forms. Stained by Pugh's stain.

OPSONINS: THEIR STUDY IN SCARLET FEVER.

The study of Opsonic factors does not necessarily lead one to the conclusion that medicine is to be revolutionised, but merely that one more weapon for diagnosis and treatment has been added to our knowledge. Treatment by inoculation controlled by the estimation of Opsonic Indices as French States opens up new fields for investigation, and, what is still more important, enables one to deal satisfactorily with some obstinate cases which have previously resisted all other methods of treatment.

We are indebted to Sir. A. E. Wright for the evolution of a working hypothesis; which assumes the presence in the Serum of man and animals; of a substance, to which he has given the name "Opsonin" which means "I cater for" derived from the Greek word *ὀπώρεω*. This substance has the power of acting on the invading Bacterium in such a way as to render it an easy prey to the Phagocyte. So far this new study has been restricted mainly to cases of Tuberculosis and Staphylococcic Infections; although one of late has heard of its being employed in cases of Pneumonia and also its relation to Dieties and Exercise have been investigated. One has been

informed that such slight changes in the food as lime juice and oranges raise the Opsonic Index. At present its study in relation to Cerebro Spinal-Meningitis and Diphtheria is being carried out in Glasgow; but as far as I am aware nothing has ever been published in regards its value in Scarlet Fever; although it has been investigated by some observers.

The Method Employed.

Although the method of procedure for testing the Opsonic changes is now fairly well known, it has been thought advisable to point out a few of the difficulties which most frequently occur. The method now usually adopted is Wright's Modification of what Leishman originally suggested.

In each case 4 separate solutions are to be prepared:-

1. An Emulsion of the Bacterium.
2. A Solution of washed Lencocytes.
3. The normal Blood Serum.
4. The Blood Serum of the patient.

which is to be tested.

The preparation of the Bacterial Emulsion.

An Emulsion of the Bacterium to be employed is made by adding a little of a recent growth to a 0.1% solution of Sodium Chloride. Now grind up the mixture in an agate mortar for a considerable time; transfer to a glass tube and centrifugalise until all the larger clumps are thrown down. The ideal is to get a uniform Solution of the Bacterium showing

67

little clumping. This object is obtained by using a 0.1% Saline Solution and not normal Saline (.75% solution) and by using the emulsion as rapidly as possible after it is made. The Bacteria tend to clump on standing.

The preparation of the Sera.

Then one has to obtain the two different Sera. The Ear, finger or thumb is pricked. I prefer the latter as one can get a very good flow of blood with a minimum amount of pricking; by tying a bandage tightly round the thumb and flexing the terminal Phalanx. Most patients strongly object to a lot of pricking.

This blood is collected in a glass tube ($\frac{1}{8}$ to $\frac{1}{4}$ inch in diameter) with a capillary end. The blood will easily run up by capillarity; although by having a tube controlled by the mouth; as in a Thoma Zeiss Blood Count, this object is more easily obtained. This latter method is not to be recommended in cases where there is a fear of self infection. The tube is sealed and then at once centrifugalised. The serum easily collects in the top part of the tube. The coagulation of the clot is greatly hastened by warming the blood in an Incubator for a few minutes.

When the serum is required for use the tube is broken across by means of a file, just above the serum and the serum used straight from the tube. Some have advised its transference to a watch glass, which is unnecessary.

The preparation of the Phagocytes.

Washed Lencocytes are obtained by adding ^{a few drops of} _{fresh blood} immediately to about 10 c.c. of a Solution of 1.5% Sodium Citrate, thoroughly mixing and centrifuging.

The Supernatant fluid is then poured off and the blood cells are then again mixed, washed & centrifuged in about the same amount of normal Saline (.75% sol.).

This should be repeated twice so that the Red Blood cells and Lencocytes have been thoroughly washed (three times in all) and are quite free from any serum. It is not necessary to state that all these operations must be carried out with strictly aseptic precautions.

The Measuring & Mixing of the Volumes.

The next step is most important as it is the measuring and mixing of the different Solutions in the right proportions. To do this Wright and Bullock recommend the use of a pipette; with a long capillary end to which is attached a rubber teat.

A mark is made with a blue pencil on the capillary part $\frac{1}{4}$ to $\frac{3}{4}$ inch from the end. This constitutes a volume. The teat is compressed and then relaxed when the fluid is to be drawn up.

One has found that an ordinary piece of drainage tube, open at both ends, will serve instead of the teat, as, owing to the capillarity and fineness of the tube the movements are apt to be too violent with a teat and it is extremely difficult to get the fluid to stop at the exact mark: hence inaccuracy occurs.

Personally I much prefer a tube, as used in performing an ordinary blood count, controlled by the mouth: one gets more accurate amounts by this means; although here again the risk of self infection must be considered.

Usually one takes up in the following order:-

3 Volumes of washed Lencocytes.

1 Volume of Bacterial Emulsion

2 or 3 volumes of the Serum to be tested.

In doing this by means of the pipette used by Wright, Bullock, Banks and others, each volume is drawn up separately, necessitating 6 or 7 different readings of the volume mark; as one soon becomes fatigued in the performance of these delicate manouvres there is plenty of room for errors to arise.

Therefore I have employed in most of my observations long thick capillary tubes which were specially drawn & were of an even calibre all the way through.

I marked on these tubes 3 consecutive volumes all of the same length ($\frac{1}{2}$ inch for instance) Now instead of drawing up 3 separate volumes of Lencocytes I draw them up all at once and did likewise with the three volumes of Serum. By this means I reduced the measuring to 3 readings, instead of 6 or 7, thereby reducing the risk of an error from this source by 50%.

This method is open to a big fallacy if the capillary tube is not of the same calibre all the way through, as one would get different amounts of fluid in each volume; hence the dilution of the Bacteria would not be the same in different tubes. The volumes must be of exact size so as to give a dilution of 1 in 6 or 1 in 7 as required in each of the tubes. One can easily measure and see if the volumes are equal by drawing up one volume of a coloured fluid and seeing if it exactly fills each length in turn.

As one usually draws up one volume of the Bacterial emulsion it can be used as a test; and those tubes where the volumes are of unequal capacities must be discarded. This is rarely

necessary if the tubes have been carefully drawn, and no time is lost by this procedure.

After the correct quantities of the 3 different Solutions have been drawn up into the tube or pipette, they are all blown out into a watch-glass. Then they are thoroughly mixed by drawing up and blowing out the mixture several times. It is then drawn up into the tube or pipette and incubated from 20 to 30 minutes.

The mixture is then thoroughly mixed again and slides are made and stained with some blood stain. Bullock prefers Leishman's stain. Some use Jenner's or even Carbol Thionin. Personally I use G. H. Wrights blood stain, which gives excellent results. One usually counts from 50 - 100 Lencocytes, noting the number of Bacteria engulfed by each cell. The ratio of the numbers absorbed, where the serum to be tested is used, and where normal serum is used, is the Opsonic Index.

Normal serum is taken as having an Opsonic Index of Unity so that the number found in 50 cells in the patients slide divided by the number in 50 cells on normal slide, gives the Opsonic Index of the patient.

ERRORS AND CRITICISMS.

X

As Watson Cheyne states, the present method of procedure cannot lay claim to absolute accuracy. If the greatest care is not taken results are inaccurate.

X

Wright and Douglas have shown that Opsonins are Thermolabile and are only present when the serum is not very old.

X

This was confirmed by Bullock and Aitken and also by Dean. Hence do not heat the serum when sealing the tubes and do not keep it long. Dexterity only gained by practice is necessary. The tubes must be incubated exactly the same period. Badly stained Bacteria cannot be seen and are often not counted.

Focus each Lencocyte separately as otherwise some Bacteria will be overlooked. A control experiment should always be made, and one should count more than one lot of 80 Polymorpho-nuclear Lencocytes. It is best to count different slides of the same mixture.

Another thing of the greatest importance is that the observer should never know which slide

- X Watson Cheyne. Lancet Jan. 13th 1906.
- X Wright and Douglas. Proc Roy Soc. Vol LXXII 1903.
- X Bullock & Aitken Proc: Roy. Soc. V. LXXVI 1905.
- X Dean Proc. Roy. Soc. V. V LXXVI 1905.

he is counting, as however conscientious he may be he is apt to be prejudiced in one direction and will count his slides accordingly. In making my observations I have always asked one of my colleagues to number the tubes and then mix them up before the slides were made, keeping the code until all counting was done.

The contradictory results so obtained were often very disheartening. Nevertheless I am perfectly certain no results can be accurate unless this precaution is taken.

Another point that has often struck me is; why does one Lencocyte take up several Bacteria whilst its neighbours take up none?

It has been explained by saying that the other Lencocytes have not come in contact with any organisms. One is inclined to think ^{that some} _^ Lencocytes have a greater inherent power of Phagocytosis than others. Certainly Eosinophile and Basophile Lencocytes do not appear to be highly Phagocytic although I have often seen the former showing marked Phagocytosis after an Intra Peritoneal inoculation. Small Lymphocytes also have small Phagocytic powers. Hence one has only counted ordinary Polymorpho-Lencocytes in these observations.

Again one has seen a certain amount of Phagocytosis; where pure Saline solution has been

added instead of serum, to leucocytes which have been washed three times. But it is true that the Opsonic Indices were very low in these cases, yet one Leucocyte was seen to contain as many as 7 Strepto-cocci.

The exact amount absorbed in these experiments are given below in the following observations.

These observations seem to point to the Leucocytes having some inherent powers of their own, and that this factor is itself variable. Hence the opsonic Index of the Serum would be rendered inaccurate, in some instances.

In tabulating my observations I shall use the following abbreviations throughout.

P.S. = Patients Serum.

My. S. = My own Serum.

Streps. = The Emulsion of Streptococcus conglomeratus.

Vol = Volumes.

L. = Leucocytes.

W. L. = Washed Leucocytes.

Abs. = Absorbed.

C. = Streptococci

Op I. = Opsonic Index.

The Opsonic Index when normal Saline is used
in place of Serum.

Observation i.

My S Vol iii Strep E Vol ii W.L.Vol iii 60 L abs 207 C Op I - 1
15 Cocci was the highest number taken up by one Leucocyte

Normal Saline Vol iii Strep E Vol ii W L Vol iii 60 L abs 76 C
Op I - .36 76 C
7 Cocci was the highest number taken up by one Leucocyte.

Observation ii.

My S Vol iii Strep E Vol i W.L.Vol iii 80 L abs 126 C Op I - 1
10 Cocci highest number taken up by one Leucocyte.

Normal Saline Vol iii. Strep E Vol i W.L.Vol iii 80 L abs 30 C
Op I - .23
4 Cocci highest number taken up by one Leucocyte.

Strain iii used in this observation.

Observation iii.

My S Vol iii Strep E Vol i W.L.Vol iii 80 L abs 140 C Op I - 1
10 C highest number taken up by one Leucocyte.

Normal Saline Vol iii Strep E Vol i W.L.Vol iii 80 L abs 8 C
Op I - .05
2 Cocci highest number taken up by one Leucocyte.

These three observations show that undoubtedly Leucocytes have some inherent power of Phagocytosis of their own, which in some cases is very considerable in that as many as 7 separate Streptococci, including a chain of 4 were engulfed by one Leucocyte.

Also this power of Phagocytosis is seen to be greatly increased by the addition of normal serum. Hence one concludes that an opsonic substance is present in the Blood Serum of healthy individuals against Streptococcus (Conglomeratus and other varieties) which can increase the Phagocytic powers of the Leucocytes .

Opsonic Observations in Normal Cases
of Scarlet Fever.

I shall now give a brief description of some of the observations I made in cases of Scarlet Fever as regards the changes in the Opsonic Indices during the course of the disease.

I shall only give those experiments which were satisfactory in every respect. It is unnecessary for me to state that at first I had many failures and in many experiments the results were contradictory. These I have not mentioned except when they occurred in the special cases I have selected to describe and which I believe to be correct.

The first set of observations will show the varying opsonic Indices in ordinary cases of Scarlet Fever as regards a special strain of Streptococcus Conglomeratus, which I have previously described. I shall first give the actual experiments and afterwards a table which will show at a glance the changes that occurred from day to day and will then give a short commentary on the results so obtained.

Case 1. Harry Moody admitted on 3rd day of Disease.

Aged 14. Symptoms Scarlatinal Erythema, Vomiting, Headache, Very dirty Throat and a Temperature of 104°F.

Observation i on 3rd day of illness.

My S Vol iii Strep Vol i. W.L.Vol iii 70 L abs 494 C Op I - 1
P.S.Vol iii Strep Vol i W.L.Vol iii 70 L abs 212 C Op I - .43

Observation ii on 5th day of illness.

Temp. still 104°F

My S Vol iii Strep Vol i W.L.Vol iii 70 L - 288 Op I - 1
P.S.Vol iii Strep Vol i W.L.Vol iii 70 L abs 146 Op I - .506

Observation iii 6th Day of Disease. Temp.

100° But much better. Throat cleaner.

My S Vol iii Strep Vol i W.L.Vol iii 40 L abs 240 C Op I - 1
P.S.Vol iii Strep Vol i W.L.Vol iii 40 L abs 244 C Op I - 1
(roughly)

Observation iv 8th Day of Disease

Temp. 99.5 Desquamation beginning.

My S Vol iii Strep Vol i W.L.Vol iii 80 L abs 150 C Op I - 1
P.S.Vol iii Strep Vol i W.L.Vol iii 80 L abs 200 C Op I - 1.33

Observation v 12th Day of Disease

Temp. normal. Desquamating freely. No Albuminuria.

My S.Vol iii Strep Vol i W.L.Vol iii 80 L abs 110 C Op I - 1
P S Vol iii Strep Vol i W.L.Vol iii 80 L abs 200 C Op I - 1.8

Observation vi 19th Day of Disease

Desquamating freely. No albuminuria.

My S Vol iii Strep Vol i W.L.Vol iii 80 L abs 160 C Op I - 1

P.S.Vol iii Strep Vol i W.L.Vol iii 80 L abs 120 C Op I - .75

Observation vii 30th Day of Disease

Still desquamating. No Albuminuria

My S Vol iii Strep Vol i W.L.Vol iii 40 L abs 248 C Op I - 1

P.S.Vol iii Strep Vol i W.L.Vol iii 40 L abs 317 C Op I - 1.2

Observation viii 40th Day of Disease

Desquamation almost finished. No

Complications.

My S Vol iii Strep E Vol ii W.L.Vol iii 60 L abs 207 C Op I - 1

P.S.Vol iii Strep E Vol ii W.L.Vol iii 60 L abs 288 C Op I - 1.39

Case II Walter Barham. aged 22.

Symptoms 2nd day of Disease, a bright Scarlatini-
form Erythema. Typical Tongue and Throat. No
Vomiting. Temperature 102° F.

Observation I. 2nd Day of Disease.

My S Vol iii Strep Vol i W.L.Vol iii 70 L abs 152 C Op I - 1

P.S.Vol iii Strep Vol i W.L.Vol iii 70 L abs 140 C Op I - .9

Observation ii 6th Day of Disease

Temp. 100 early desq. beginning.

My S Vol iii Strep Vol i W.L.Vol iii 60 L abs 720 C Op I - 1
 P.S.Vol iii Strep Vol i W.L.Vol iii 60 L abs 454 C Op I - .63

Observation iii 9th Day of Disease

Desquamating freely. No complication

Temperature normal.

My S Vol iii Strep Vol i W.L.Vol iii 80 L abs 104 C Op I - 1
 P.S.Vol iii Strep Vol i W.L.Vol iii 80 L abs 180 C Op I - 1.73

Observation iv 12th Day of Disease

Desquamating freely. Temp. normal no
 complication.

My S Vol iii Strep Vol i W.L.Vol iii 80 L abs 110 C Op I - 1
 P.S.Vol iii Streps Vol i. W.L.Vol iii 80 L abs 224 C Op I - 2.03

Observation v 19th Day of Disease.

Desquamating freely no complications

My S Vol iii Streps Vol i W.L.Vol iii 80 L abs 160 C Op I - 1
 P.S.Vol iii Streps Vol i W.L.Vol iii 80 L abs 110 C Op I - .68

Observation vi 30th Day of Disease

Disquamating freely No complications

My S Vol iii Strep Vol i W.L.Vol iii 80 L abs 152 C Op I - 1
 P.S.Vol iii Strep Vol i W.L. Vol iii 80 L abs 172 C Op I - 1.1

Observation vii 40th Day of Disease

Disquamation almost finished.

My S Vol iii Strep E Vol ii W.L.Vol iii 60 L abs 207 C Op I - 1
 P.S.Vol iii Strep E Vol ii W.L.Vol iii 60 L abs 256 C Op I - 1.2

Case III Florence Chivers aged 5.

Admitted with a Typical Scarlatinal Rash.
 Injected Throat and furred and papillated
 Tongue. Temp 102°

Observation i 2nd Day of Disease.

My S Vol iii Strep Vol i W.L.Vol iii 80 L abs 72 C Op I - 1
 P.S.Vol iii Strep Vol i W.L.Vol iii 80 L abs 100 C Op I - 1.39

Observation ii 5th Day of Disease.

Rash still evident. No Albuminuria
 Fauces cleaner. Temp. 100°

My S Vol iii Streps i W.L.Vol iii 40 L abs 55 Op I - 1
 P.S.Vol iii Streps i W.L.Vol iii 40 L abs 136 Op I - 2.4

Observation iii 11th Day of Disease

Fauces clean. Desquamating freely. No
 complications. Temperature normal.

My S. Vol iii Strep Vol i W.L.Vol iii 80 L abs 160 C Op I - 1
 P.S.Vol iii Strep Vol i W.L.Vol iii 80 L abs 88 C Op I - .55

Observation iv 20th Day of Disease

My S Vol iii Strep E Vol i W.L.Vol iii 80 L abs 152 C Op I - 1
 P.S.Vol iii Strep E Vol i W.L.Vol iii 80 L abs 82 C Op I - .55

Observation v 46th Day of Disease

Desquamation almost finished.

My S Vol iii Strep E Vol ii W.L.Vol iii 60 L abs 207 C Op I - 1
 P.S.Vol iii Strep E Vol ii W.L.Vol iii 60 L abs 404 C Op I - 1.9

Case iv. Annie Knight aged 15.

Admitted 2nd day of illness with a bright and brilliant Scarlatinal Rash, a Typical Tongue and Throat. Temp 103.2°F

Observation i 2nd Day of Disease.

My S Vol iii	Strep Vol i	W.L.Vol iii	80 L abs	250 C	Op I - 1
P.S.Vol iii	Strep Vol i	W.L.Vol iii	80 L abs	110 C	Op I - .44

Observation ii 6th Day of Disease

Temp. still up 102, but pat. seemed much better. Throat cleaner and Rash fading.

Two separate estimations were here made.

My S Vol iii	Strep Vol i	W.L.Vol iii	80 L abs	160 C	Op I - 1
P.S.Vol iii	Strep Vol i	W.L.Vol iii	80 L abs	172 C	Op I - 1.07
My S Vol iii	Strep Vol i	W.L.Vol iii	40 L abs	300 C	Op I - 1
P.S.Vol iii	Strep Vol i	W.L.Vol iii	40 L abs	284 C	Op I - .9

Observation iii 15th Day of Disease

Desquamating freely Temp.normal. no complications.

My S Vol iii	Strep Vol i	W.L.Vol iii	80 L abs	460 C	Op I - 1
P.S. Vol iii	Strep Vol i	W.L.Vol iii	80 L abs	494 C	Op I - 1.07

Observation iv 23rd Day of Disease.

Still desquamating. No complications.

My S Vol iii	Strep Vol i	W.L.Vol iii	80 L abs	152 C	Op I - 1
P.S.Vol iii	Strep Vol i	W.L.Vol iii	80 L abs	75 C	Op I - .49

Observation v 40th Day of Disease.

Desquamating now only slightly.

My S Vol iii	Strep Vol i	W.L.Vol iii	60 L abs	207 C	Op I - 1
P.S.Vol iii	Strep Vol i	W.L.Vol iii	60 L abs	425 C	Op I - 2.05

Case V Rose Branridge aged 15.

Admitted 2nd day of illness with a bright
Scarlatinal Rash, Typical Tongue, Vomiting,
Headache and sore Throat. The Fauces were ul-
cerated with a lot of exudation and were
very dirty. Temp. 102.2

Observation i. 2nd day of illness.

My S Vol iii	Strep Vol i	W.L.Vol iii	80 L abs	160 C	Op I - 1
P.S.Vol iii	Strep Vol i	W.L.Vol iii	80 L abs	110 C	Op I - .68

Observation ii 10th Day of illness.

Temp. normal. No complications

My S Vol iii	Strep Vol i	W.L.Vol iii	80 L abs	100 C	Op I - 1
P.S.Vol iii	Strep Vol i	W.L.Vol iii	80 L abs	185 C	Op I - 1.8

Observation iii 19th day of illness.

Temp. normal, free desquamation, no complications.

My S Vol iii	Strep Vol i	W.L.Vol iii	40 L abs	62 C	Op I - 1
P.S.Vol iii	Strep Vol i	W.L.Vol iii	40 L abs	25 C	Op I - 0.4

Here a very weak emulsion of Bacteria was used.

Observation iv 46th Day of Disease.

Temp. normal. Desquamation almost finished.

My S Vol iii	Strep Vol i	W.L.Vol iii	80 L abs	152 C	Op I - 1
P.S.Vol iii	Strep Vol i	W.L.Vol iii	80 L abs	199 C	Op I - 1.3

Table showing the Opsonic values on the different days of Disease.

Day of Disease	2	3	4	5	6	7	8	9	10	12
Harry Moody		.43		.506	.1		1.33			1.8
Walter Banham	.9				.63			1.73		2.03
Flo. Chivers	1.39			2.4					.55	
Annie Knight	.44				1.07 .9					
Rose Branridge	.68								1.8	

1st Week

2nd Week.

Day of Disease	15	19	20	23	30	40	46
Harry Moody		.75			1.2	1.39	
Walter Banham		.68			1.1	1.2	
Flo. Chivers			.55				1.9
Annie Knight	1.07			.49		2.05	
Rose Branridge		0.4					1.3

3rd Week

4th Wk

5th
Wk.

6th Wk.

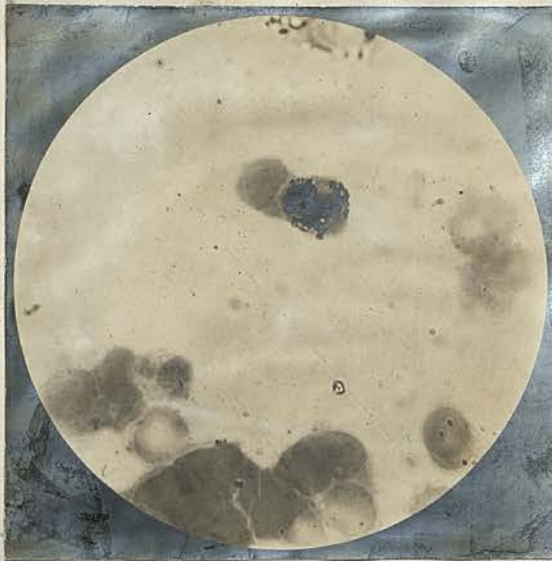
From these results one sees that in the very early stages of the disease when the temperature is high, the opsonic Index is generally speaking low, although in the case of Florence Chivers it was seen to be higher than usual (1.38) This is probably due to some inaccuracy on my part in making the observation.

As the temperature settles down the Opsonic Index rises to about normal and if anything remains a little above normal until the end of the 3rd week, when it reaches its minimum. Not all my observations show these changes but in the 7 observations made during the 2nd week and beginning of the 3rd week in 6 cases the Opsonic Index was undoubtedly slightly above normal. Whilst of the 5 observations made towards the end of the 3rd week and beginning of the 4th week one finds the Opsonic Index below normal in every instance and on two occasions it fell as low as .4. After the 4th week the Opsonic Index gradually rises to reach its maximum about the end of the 6th week. The high Opsonic Index towards the end of convalescence is the most striking in these observations. On one occasion it was more than double the normal Opsonic Index.

Although these changes in the Opsonic Index are especially well marked as regards *Streptococcus Conglomeratus*, they are also seen to be present as regards other varieties of *Streptococcus* (as *S. Pyogenes*) This fact is not to be greatly wondered at as all the strains of cocci used in my observations were isolated from the throats of Scarlet Fever Patients.

Although these observations are possibly too scanty to come definitely to these conclusions, one is inclined to consider them correct from the many other observations made but not recorded here.

Below are some of the microphotographs of the actual slides made for these observations



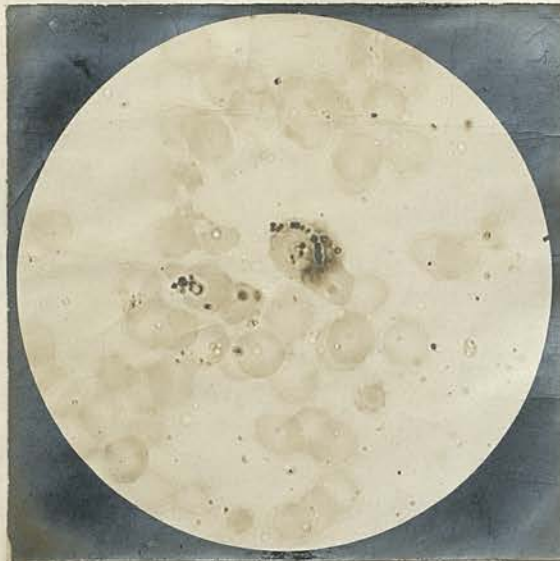
Shows a single Leucocyte which is simply packed with Cocci. Note the involuted forms of some of the Cocci. The chains are well seen. Case Annie Knight 40th day of Disease.



This photograph shows one Leucocyte crowded with Cocci which do not show many involuted forms. Note the chains and also complete absence of cocci in rest of field. 6th week Scarlet. Florence Chivers.



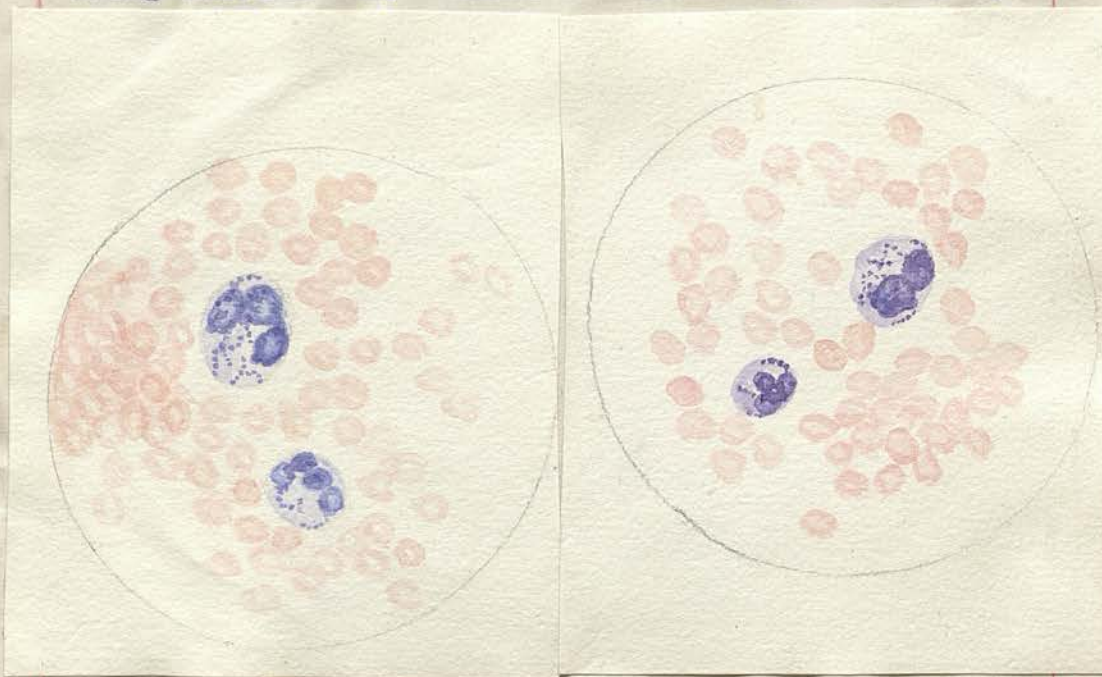
This photograph shows two Leucocytes one of which has engulfed a long chain of Streptococci which is curled up. An excellent photograph.



This photograph shows a few Streptococci in a Leucocyte. Here the Phagocytosis was not so strong. 21st day of Scarlet Fever.



This photograph shows two Leucocytes which have taken up a few cocci. Not a very strong Phagocytosis. This slide has been spoilt by not being sufficiently washed and shows a lot of dirt.



The above is an hand painted drawing of an actual slide and shows very well the chains within the cells.

The Opsonic changes in Scarletinal Nephritis
as regards Streptococcus conglomeratus.

Under this heading I shall first briefly
describe the observations I have made in a series of
6 definite cases of Scarletinal Nephritis, at the
end of which I give a table of the actual results
and a short commentary.

Case i Albert Baldry, aged 24.

4th week Scarlet Fever. Blood and Albumin
for last two weeks. Temp. normal.

Observation i 14th Day Scarletinal Nephritis.

My S Vol iii Strep E i W.L.Vol iii 80 L abs 494 C Op I - 1

P.S.Vol iii Strep E i W.L.Vol iii 80 L abs 400 C Op I - .809

Observation ii 28th Day of Scarlatinal Nephritis.

Still blood and albumin in urine.

My S Vol iii Strep E Vol i W.L.Vol iii 40 L abs 8 C Op I - 1

P.S.Vol iii Strep E Vol i W.L.Vol iii 40 L abs 2 C Op I - .25

Here a very weak Bacterial

Emulsion was used.

Observation iii 28th day of Scarlatinal Nephritis

Still blood and albumin

My S Vol iii	StrepE Vol i	W.L.Vol iii	40 L abs 62 C	Op I - 1
P.S.Vol iii	Strep E Vol i	W.L.Vol iii	40 L abs 10 C	Op I -.16

In this last observation a different strain of Streptococcus was used.

Probably Streptococcus Pyogenes (Longus) Strain iii.

Case ii. William Clout. aged 13 years

Admitted 4th day of disease, with a very dirty Throat and Septic Morbilliform Rash.

Temp. 104°2. 12th day of disease free.

Desquamation. But Temp. 102° with vomiting and blood and albumin in Urine. The patient has Phthisis, Pulmonalis, Cavity formation at Rt. apex.

Observation i 3rd Day of Nephritis

My S Vol iii	Strep E Vol i	W.L.Vol iii	80 L abs 494 C	Op I - 1
P.S.Vol iii	Strep E Vol i	W.L.Vol iii	80 L abs 398 C	Op I -.800

Observation ii 7th day of Nephritis

My S Vol iii	Strep E Vol i	W.L.Vol iii	80 L abs 124 C	Op I - 1
P.S. Vol iii	Strep E Vol i	W.L.Vol iii	80 L abs 104 C	Op I -.83

Observation iii 8th day of Nephritis

My S Vol iii Strep E Vol i W.L.Vol iii 80 L abs 28 C Op I - 1
 P.S. Vol iii Strep E Vol i W.L.Vol iii 80 L abs 16 C Op I - .57

In this last observation a very weak
 solution of (Strain iii) was used.

Case iii. Leonard Reynolds. aged $9\frac{8}{12}$ years

Admitted 3rd day of Scarlet Fever with
 Typical Rash, Tongue, and Sore Throat,
 which was very dirty.

On 12th day patient began to pass blood
 and albumin with a rise of Temperature.

Observation i 5th day of Nephritis

My S Vol iii Strep E Vol i W.L.Vol iii 80 L abs 300 C Op I - 1
 P.S.Vol iii Strep E Vol i W.L.Vol iii 80 L abs 88 C Op I - .29

Observation ii 10th day of Nephritis

Still blood and albumin in Urine

My S Vol iii Strep E Vol i W.L.Vol iii 80 L abs 124 C Op I - 1
 P.S.Vol iii Strep E Vol i W.L.Vol iii 80 L abs 90 C Op I - .72

Observation iii 11th day of Nephritis

My S Vol iii Strep E Vol i W.L.Vol iii 80 L abs 30 C Op I - 1
 P.S.Vol iii Strep E Vol i W.L.Vol iii 80 L abs 28 C Op I - .93

Here a very weak Solution of
 Strain iii was used.

Cash iv Albert Stagg. aged 7.

Admitted 2nd day of illness with 2 sisters
 and 1 brother, all developed V.bad Nephritis
 and one sister died. This patient passed
 blood and albumin for 10 weeks and was
 discharged with a little albuminuria

Observation i 12th day of Nephritis

My S Vol iii Strep E Vol i W.L.Vol iii 80 L abs 482 C Op I - 1
 P.S.Vol iii Strep E Vol i W.L.Vol iii 80 L abs 594 C Op I - 1.2

This shows a slightly raised Opsonic Index

Observation ii 18th day of Nephritis

My S Vol iii Strep E Vol i W.L.Vol iii 80 L abs 124 C Op I - 1
 P.S.Vol iii Strep E Vol i W.L.Vol iii 80 L abs 44 C Op I - .34

Observation iii 18th Day of Nephritis

My S Vol iii Strep E Vol i W.L.Vol iii 40 L abs 16 C Op I - 1
 P.S.Vol iii Strep E Vol i W.L.Vol iii 40 L abs 0 C Op I - 0

Here a weak solution of Strain iii was used and no Phagocytosis was seen at all in this slide.

Observation iv. 20th day of Nephritis

My S Vol iii Strep E Vol i W.L.Vol iii 80 L abs 140 C	Op I - 1
P.S.Vol iii Strep E Vol i W.L.Vol iii 80 L abs 130 C	Op I - .92

Case V. Edith May Adams. aged 6

Admitted with a Bright typical Rash, Tongue and Fauces. Temp. 103.6°. Had subacute Nephritis for 2 months

Observation i. 30th day of Nephritis

My S Vol iii Strep E Vol i W.L.Vol iii 80 L abs 494 C	Op I - 1
P.S.Vol iii Strep E Vol i W.L.Vol iii 80 L abs 564 C	Op I - 1.1

This shows a raised opsonic Index.

Observation ii. 40th day of Nephritis

My S Vol iii Strep E Vol i W.L.Vol iii 80 L abs 124 C	Op I - 1
P.S.Vol iii Strep E Vol i W.L.Vol iii 80 L abs 105 C	Op I - .8 ✓

Case VI. Evelyn Cook. aged 22 (A Nurse)

Admitted 3rd day of Disease with a bright
Typical Rash, Sore Throat, Vomiting and
Headache.

Desquamated freely. On the 20th day of
disease she suddenly passed large quantities
of blood and Albumin with rise of Temperature.
This lasted for 10 weeks and she was discharged
with slight albuminuria.

Observation i. 4th day of Nephritis

My S Vol iii Strep E Vol i W.L.Vol iii 80 L abs 110 C	Op I - 1
P.S.Vol iii Strep E Vol i W.L.Vol iii 80 L abs 124 C	Op I - 1.12

Observation ii. 6th Day of Nephritis

My S Vol iii Strep E Vol i W.L.Vol iii 80 L abs 72 C	Op I - 1
P.S.Vol iii Strep E Vol i W.L.Vol iii 80 L abs 28 C	Op I - .3

Here a weak solution was used Strain iii

Observation iii 12th day of Nephritis

My S Vol iii Strep E Vol i W.L.Vol iii 80 L abs 140 C	Op I - 1
P.S.Vol iii Strep E Vol i W.L.Vol iii 80 L abs 96 C	Op I - .68

Day of Disease	3	4	5	6	7	8	10	11	12	18	14	20	28	30	40
Albert Baldry												.809	(.25 .16		
William Clout	.800				.83	.57									
Leonard Reynolds		.29					.72	.93							
Albert Stagg									1.2	(.34 0		.92			
Edith M Adams														1.1	.8
Evelyn Cook	1.12			.3					.68						

From these observations one concludes that the opsonic index is low in Scarlatinal Nephritis against Streptococcus. This is especially well marked where S. Conglomeratus was used ; although it was still evident where S. Pyogenes was employed. In 14 out of 17 observations the opsonic Index was seen to be low. On only 3 occasions was it found to be higher than normal. I am inclined to think that these latter results are not correct and are due to some error in technique. Or possibly some other influence as food etc may have temporarily raised the Opsonic Index. Hence one concludes from the large majority of these observations that the Opsonic Index is low in Scarlatinal Nephritis against Streptococcus.

The Opsonic Index in very severe and acute cases.

In cases of Scarlet Fever where the infection is very acute and the patient is quickly overcome by the disease and is often in a very septic condition one has found that the opsonic index is invariably low as regards all forms of Streptococcus. Below are some observations made during the acute Stages of such a condition.

It has been suggested that the inoculation of minute quantities of dead Streptococci in these cases would raise the opsonic Index and so do good. I have not been able to do this myself, but in one case where this procedure was adopted I am informed that the Opsonic Index rose definitely, although the patient did not seem to improve very much under the Treatment.

Observation i.

Mrs. Rose Gillham, age 27. The 16th day of disease Temperature been high from 102 - 104.5 since admission. She had a very profuse rash now desquamating in large scales. The cervical glands are very swollen. Fauces and Mouth very dirty. Tongue dry and brown. She had Rt. otorrhoea, slight Rheumatic pains and very slight Albuminuria
Diagnosis a Septic Scarlet Fever

My S Vol iii Strep E Vol ii W.L.Vol iii 60 L abs 207 C Op I - 1
P.S.Vol iii Strep E Vol ii W.L.Vol iii 60 L abs 154 C Op I - .7

Observation ii

Harry Hardcastle aged 2. The 11th day of Disease.

Temp. now 102, varying from 102 - 104 since admission.

The cervical glands were intensely swollen. There was a profuse purulent nasal discharge. Lips were excoriated. There was marked Stomatitis and ulceration of the Tonsils and Palate. Desquamation was well marked. There was no albuminuria.

Diagnosis Septic Scarlet Fever.

My S Vol iii Strep E Vol ii W.L.Vol iii 60 L abs 207 C Op I - 1

P.S.Vol iii Strep E Vol ii W.L.Vol iii 60 L abs 102 C Op I - .4

Observation iii

George Godfrey. 7th day of disease. Patient had

a very brilliant rash on admission. Temperature

varied 105° to 103°. Has a severe cervical

adenitis. Profuse purulent nasal discharge. Tonsils

covered with exudation. Mouth very dirty. Has a

lot of albuminuria

My S Vol iii Strep E Vol i W.L.Vol iii 80 L abs 126 C Op I - 1

P.S.Vol iii Strep E Vol i W.L.Vol iii 80 L abs 60 C Op I - .4

The Opsonic Index in Relation to Staphylococcus.

After several observations made on the changes in the Opsonic Index as regards Staphylococcus in cases of Scarlet Fever, I have not been able to come to any conclusion. Except that in those cases where the Throat is very dirty swarming with Staphylococci during the early stages of the infection.

The Opsonic Index is very high when the Throat has become quite clean. Below are some observations and a Photograph showing this fact.

Case i Walter Banham aged 22, an ordinary case of Scarlet Fever with a lot of exudation and ulceration of Tonsils on admission.

Observation i. Throat now quite clean 8th day of disease

My S Vol iii	Staph Vol i	W.L.Vol iii	60 L abs 46 C	Op I - 1
P.S.Vol iii	Staph Vol i	W.L.Vol iii	60 L abs 89 C	Op I - 1.93

Case ii Walter Moody. aged 12. an ordinary case of Scarlet Fever with a very dirty Throat. Many Staphylococci found on cultivation of a swab.

Observation ii 14th day of disease. Throat now quite clean.

My S Vol iii	Staph Vol i	W.L.Vol iii	40 L abs 147 C	Op I - 1
P.S.Vol iii	Staph Vol i	W.L.Vol iii	40 L abs 300 C	Op I - 2.04

See Photograph below

Observation iii

Case iii Branridge Rose. an ordinary case of Scarlet
Fever with a very dirty Throat swarming with
Staphylococci on cultivation.

My S Vol iii Staph Vol i W.L.Vol iii 40 L abs 300 C Op I - 1

P.S.Vol iii Staph Vol i W.L.Vol iii 40 L abs 402 C Op I - 1.33



This Photograph shows 6 Leucocytes which are
engulfing several Staphylococci - a strong Phagocytosis.
Case Walter Moody . 14th day of disease.

Conclusions:

Those patients who suffer from Septic Inflammation of the fauces and lymphatic glands are more likely to develop Renal complications.

Hypertrophied, fissured and lobulated Tonsils are most likely to become inflamed, hence they dispose to Scarlatinal Nephritis; the risk of which can be lessened by the prolonged cleaning of the throats after the acute stages have subsided.

Pus is frequently present in the mastoid antrum in bad cases of Scarlet Fever when there are no manifestations of this complication.

Wilde's incision if made early, often checks the inflammatory changes in the middle ear and antrum rendering a further operation unnecessary.

The early application of ice bags is the best local treatment for Scarlatinal Adenitis.

The present method for ~~gaging~~ the Opsonic Index is often subject to great errors, and most results are not beyond severe criticism.

Apparently some Leucocytes have a greater power of Phagocytosis than others. This must be considered in determining the opsonic index of a Blood serum.

An opsonic body is present in normal and abnormal sera, in varying amounts against Streptococcus Conglomeratus.

It varies definitely in all cases of Scarlet Fever. It is very low when the temperature is high at the onset of the disease, but increases as the acute stage subsides, then falls again towards the end of the 3rd week and beginning of 4th but rises and reaches its maximum during the 6th or 7th weeks. No such variations were found in relation to staphylococcus.

Different strains of Streptococcus do not vary in their effect on the Opsonic Index if isolated from Scarlet Fever patients.

The Opsonic Index against Streptococcus is very low, in very acute and septic cases which often end fatally.

This Opsonic Index is low in all cases of

Scarlatinal Nephritis.

A persistent low Opsonic Index infers a bad prognosis.

Streptococci are often present in the Kidneys of fatal cases of Nephritis although Staphylococcus is often more easily isolated. But as the opsonic Index is so markedly decreased against Streptococcus it probably is the main cause of this complication, but possibly is aided by other microorganisms as Staphylococcus.

Streptococcus Conglomeratus is usually present in the throats of Scarlet Fever patients, especially from the 16th to 26th day of disease (the Albuminuria period) It is characterised by its polymorphic nature and delicate growth.